Trimble Perspective

User Guide

Trimble.

Corporate Office

Trimble Inc.

935 Stewart Drive

Sunnyvale, CA 94085

USA

www.trimble.com

GeoSpatial business area

Trimble Inc.

10368 Westmoor Drive,

Westminster, CO 80021

USA

800-538-7800 (toll free in USA)

+1-937-245-5600 Phone

+1-937-233-9004 Fax

www.trimble.com/support/

Trimble Europe B.V.

Industrieweg 187A

5683 CC Best

The Netherlands

Legal Notices

Release Notice

This is the January 2025 (Version 2025.10) release of the Trimble Perspective user guide.

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What's New?

Following are the major new features and enhancements in Trimble Perspective:

RELEASE 2025.10

- NON-GRIDDED E57 FORMAT FILE: You can export the selection (whether it's a project, a set of stations or a region defined with the Limit Box) to a single non-gridded E57 format file.

- LAS 1.4 FORMAT FILE: You can export the selection (whether it's a project, a set of stations or a region defined with the Limit Box) to one LAS 1.4 format file.

- EXPORT OVERALL REFINED LINKS IN TDX FORMAT: The overall refined links, which refers to the results of refining the alignment and transformation of the datasets to improve their accuracy after a registration, are exported when you export your project to the TDX format. When you import the TDX format project into Trimble RealWorks (only), these links are imported as well. You can then use the Adjust Registration in Trimble RealWorks to check and adjust them.

- LIMIT BOX: You can restore the last saved limit box.

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Introduction

Trimble **Perspective** is an infield application with a user-friendly interface that puts you in control. It is easy to use. It lets you intuitively:

- Collect and automatically register the scan data in the field with the Trimble X7, X9, X9 Core (500 kHz- 80 m), X9 Premium (1000 kHz - 150 m) and X12 3D laser scanner.

- Increase the field-to-office productivity with labels, annotations, precision points, target extraction and measurement tools.

- Augment your survey data with a scan of a specific area of interest.

- Refine and georeference the project directly in the field.

- Finalize, and hand off the project or export it to industry standard file formats.

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Get Started

As a new Trimble Perspective user, it is a good idea to familiarize yourself with the user interface, and all of its components.

System Specifications

TABLET: A Trimble **T10x** Tablet has the below specifications. If you use a commercial tablet instead, ensure it has to meet the minimum specifications of the T10x tablet:

- **Operating System**: Microsoft® Windows 10 and 11 (64 bit)

- **System**:

    Energy efficient Intel 10th Generation Core™ i7 Processor

    32 GB RAM

    1 TB Storage

    10.1 in (256 mm) 1000 Nits 1920 x 1200 LCD Screen

    8 MP rear camera

    High capacity hot swappable batteries

- **Communication**:

    Wi-Fi 802.11ax

    USB 3.0 x1

    LAN Port RJ45 x1

> **NOTE –** It is recommended updating the graphic card of your tablet with the most recent version of the driver. Please visit the manufacturer website to get the most recent driver version.

DESKTOP & LAPTOP: The Trimble Perspective software can be installed and run on a Windows desktop (or laptop) instead of on a Trimble **T10x** Tablet. The minimum specifications should be similar to or higher than the **T10x** Tablet ones.

TRIMBLE PERSPECTIVE: Throughout this user guide, the Trimble Perspective software will be referred to as the software, or the application.

TRIMBLE 3D LASER SCANNER: A Trimble X series is a 3D laser system. Throughout this user guide:

- The Trimble X7 3D laser system will be referred to as the X7 scanner or **X7** .

- The Trimble X9 Core (500 kHz - 80 m) or Premium (1000 kHz - 150 m) 3D laser system will be referred to as the X9 scanner or **X9** .

- The Trimble X12 3D laser system will be referred to as the X12 scanner or **X12** .

> **NOTE –** It is recommended updating the scanner with the most recent version of the firmware. Use Trimble Installation Manager for Windows to update your scanner firmware. For more information, refer to the user guide of the respective scanner.

MEMORY CARD: Trimble recommends using SDHC memory cards (which are by default formatted in the FAT32 file system) with a minimum size of 32GB, a class 10 speed and a temperature ranging from -20°C to 85°C. If you

choose to use an extended capacity SDXC memory card, it must meet the specifications given above and must be formatted in the FAT32 file system.

> **NOTE –** Use the **Storage** management features of the Trimble Perspective software to ensure that the SDXC memory card is formatted in the FAT32 file system. See ⚙ **Settings** > Scanner.

Install Trimble Perspective

The Trimble Perspective software can be installed on a Windows Desktop, Laptop or Tablet.

Before installing or updating the Trimble Perspective software:

- Make sure you have the required software license to install the Trimble Perspective software.

- If the Trimble Installation Manager software is not installed on the controller, download it and install it. See Trimble Installation Manager.

CAUTION – You must be an administrator on the controller where you want to install the Trimble Perspective software.

NOTE – After starting the software, a database with a default path "C:\users\username\AppData\Local\Trimble Perspective DB" is created. Optionally, you can change the default path. See Define Projects Path and UTF-8 Characters In Database Path.

Software Licenses

You can purchase a Trimble Perspective software license as a perpetual license that is licensed to a controller or as a subscription license that is assigned to an individual user. A perpetual license works perpetually (there is no expiry date). A subscription license will stop working after the expiry date.
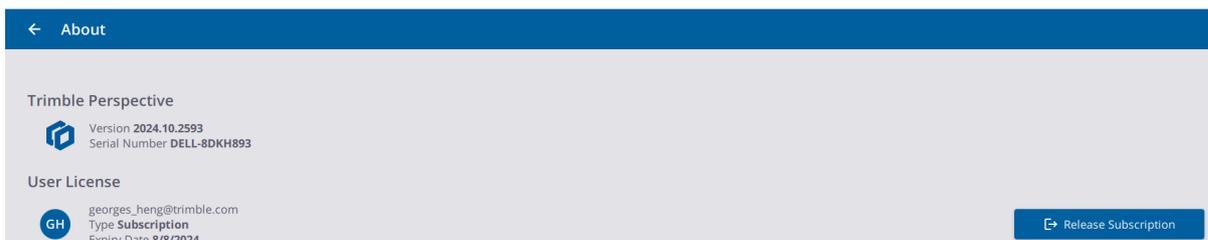
To view the license information installed on the controller, tap ☰ **Menu** > ⓘ **About** to open the box.

- **PERPETUAL LICENSE**: A perpetual license is permanent with no expiry date. No renewals are required and you do not have to sign in with your TID to use the license.

  ← **About**

  Trimble Perspective
  Version **2024.10.2593**
  Serial Number **DELL-8DKH893**

  License

  Type **Perpetual**

- **SUBSCRIPTION LICENSE**: Sign in with your TID to use your subscription license. See Sign In and Sign out Using Your TID Account.

  When your subscription is still valid:

  ← **About**

  Trimble Perspective
  Version **2024.10.2593**
  Serial Number **DELL-8DKH893**

  User License

  GH georges_heng@trimble.com
  Type **Subscription**
  Expiry Date **8/8/2024**   [→ Release Subscription]

  When your subscription license has expired, and it is not renewed or updated by the specific renewal date, it enters a five-day grace period (called **Renewal**).

  ← **About**

  Trimble Perspective
  Version **2024.10.2593**
  Serial Number **DELL-8DKH893**

  User License

  GH georges_heng@trimble.com
  Type **Renewal**
  Expiry Date **8/9/2024**   [→ Release Subscription]
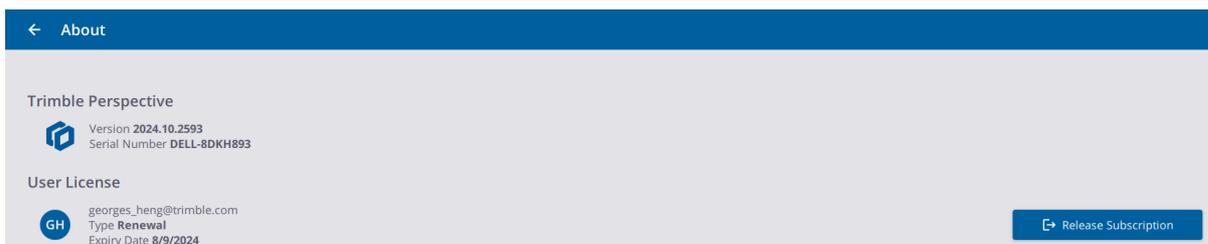
  Once the **Renewal** period has expired, your subscription license enters a two-day emergency period (called **Temporary**). See Temporary License.
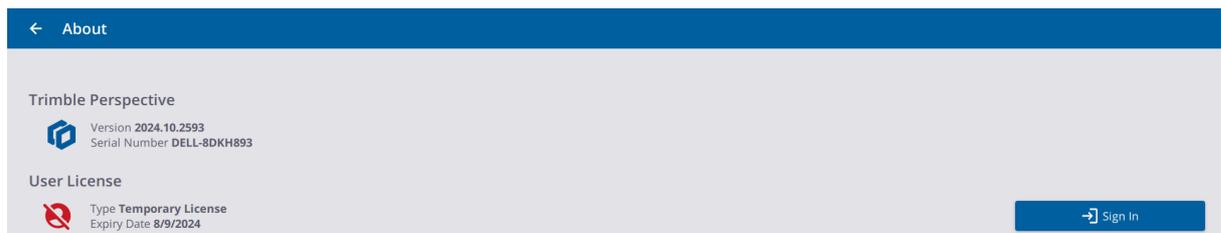
Once the two periods have expired, Perspective can no longer operate until you renew your license or purchase a new one.

Notifications that appear when your subscription license:

○ Expires soon (less than 30 days).

○ Enters the Renewal period.

○ Enters the Temporary period. See Temporary License.

Warnings that appear when your subscription license:
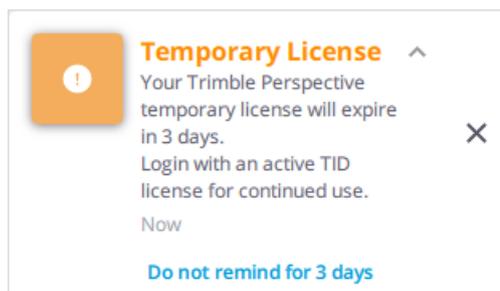
○ Is locked on a device, and you want to use it on any other device:

Error

Your license is locked to another device. Log out of that device to continue or use another TID account.

OK

○ And the **Renewal** period has expired:

Warning

Your Trimble Perspective License has expired. Login with an active TID license for continued use or contact your dealer to renew your subscription.

You may activate a temporary Trimble Perspective license

OK
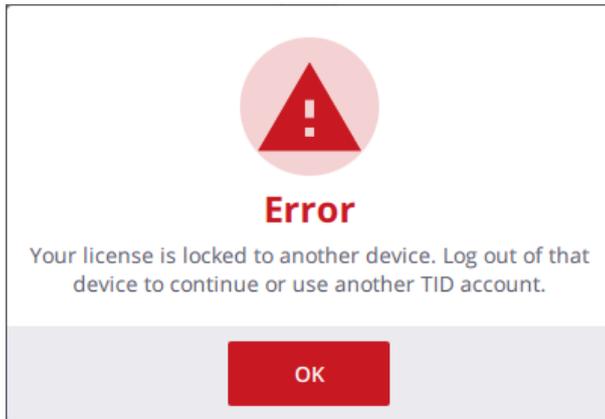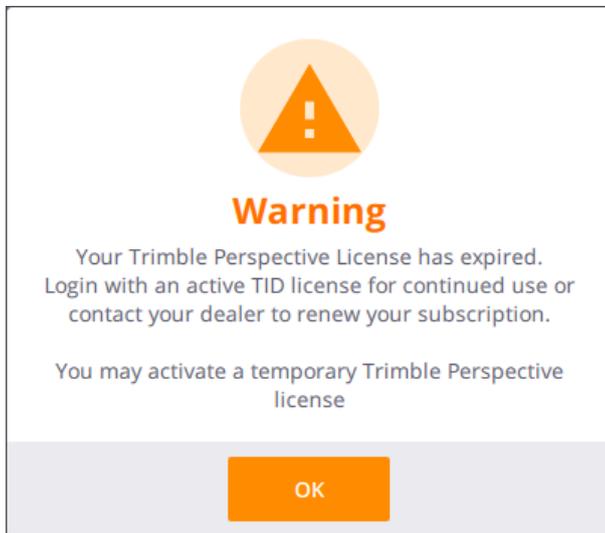
○ And the **Renewal** and **Temporary** periods have expired:

Error

Your Trimble Perspective License has expired. Login with an active TID license for continued use or contact your dealer to renew your subscription.

OK
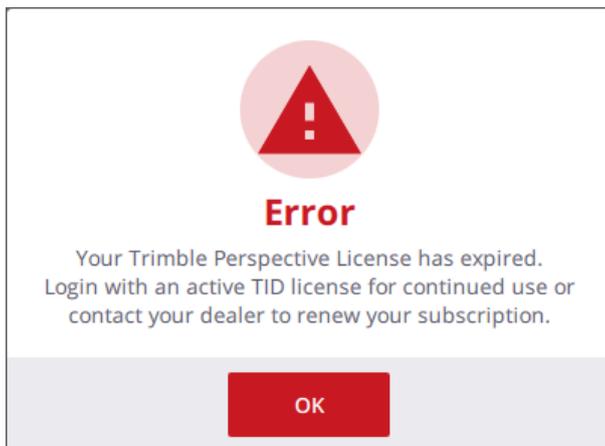
- **TEMPORARY LICENSE**: Occasionally you may not be able to sign in to use your Trimble Perspective subscription. This can happen if your subscription has lapsed, or is locked to another controller. In this case, you can create a 48-hour license to use until you can renew your subscription, or login in with a valid license, or unlock your subscription from the other controller.

  To create a 48-hour license, click the "Activate a temporary Trimble Perspective license" link. In the Temporary License dialog, click Start.
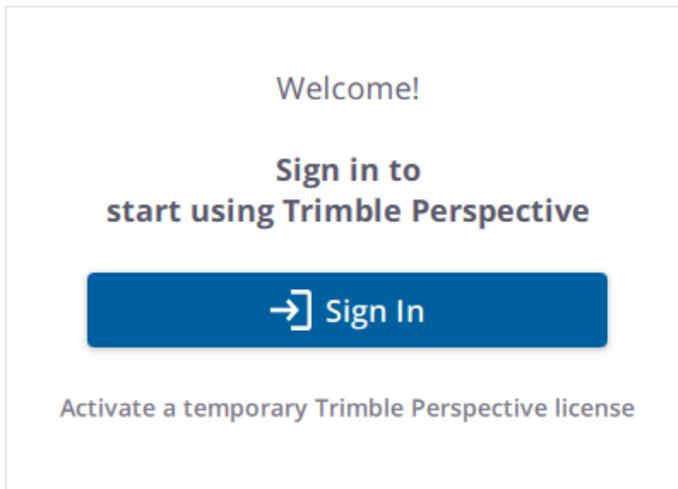
  > **NOTE –** You can be off line (no Internet) to activate a temporary Trimble Perspective license.

- **WARRANTY**: Every Trimble Perspective software must be licensed in order for you to install and operate the software. A Trimble Perspective license comes with a warranty and an expiry date which is the last day of service, meaning that the warranty and the license will expire after that expiry date. New improved versions of the software require a valid warranty. If the software warranty has expired, you can continue to operate the software. The software warranty expiry date is shown only if you have a perpetual software license. If you have a subscription, you can install new, improved versions of the software as long as the subscription is valid.

  After every restart of Perspective, a notification is displayed informing about the warranty expiry date.

  - Is close to expiry (less than one month).
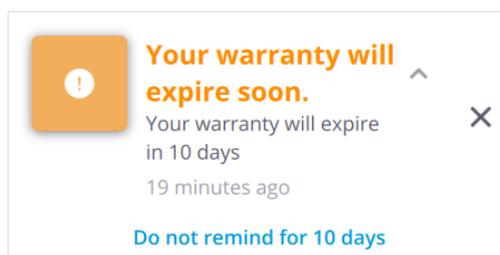
○ Has expired.
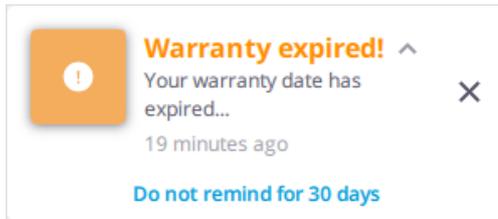
To not display the notification, tap the "**Do Not Remind for ...**" link.

> **NOTE –** The warranty expiry date is displayed in the **About** box. Tap ☰ **Menu** > ⓘ **About** to open the box.

Sign In and Sign out Using Your TID Account

The goal of Trimble Identity, or TID, is to have a single place to access all the Trimble products, services, and subscriptions under one email. If you have subscribed to a license, log in with your TID to use the license.

> **NOTE –** To sign in or to sign out, you must be connected to the Internet.

Sign In

1. Start the Trimble Perspective software. The **Welcome** page opens.

2. Tap the ⤵ **Sign In** icon. The **Trimble Identity** web page opens.

3. In the **Sign In** pane, do any of the following:

   Enter your **Trimble Identity (TID)** credentials and click **Next**.

   Select to log in using Google, Apple or Microsoft.

   Click the **Create a Trimble ID** link to create a free new TID account.

> **NOTE –** You stay signed in after leaving Perspective without releasing the subscription.

Release Your Subscription and Sign Out

By default, a license for a Trimble Perspective subscription is locked to the controller until you release it. To use the subscription license on a different controller, you must release the subscription on the current controller and sign out.

Tap ☰ **Menu** > ⓘ **About** and then tap ↪ **Release My Subscription**.

> **NOTE –** You cannot release your subscription if you are not connected to the Internet.

User Interface

The Trimble Perspective software user interface looks typically as shown below. It is a good idea to familiarize yourself with it, and all of the components that are described hereafter.
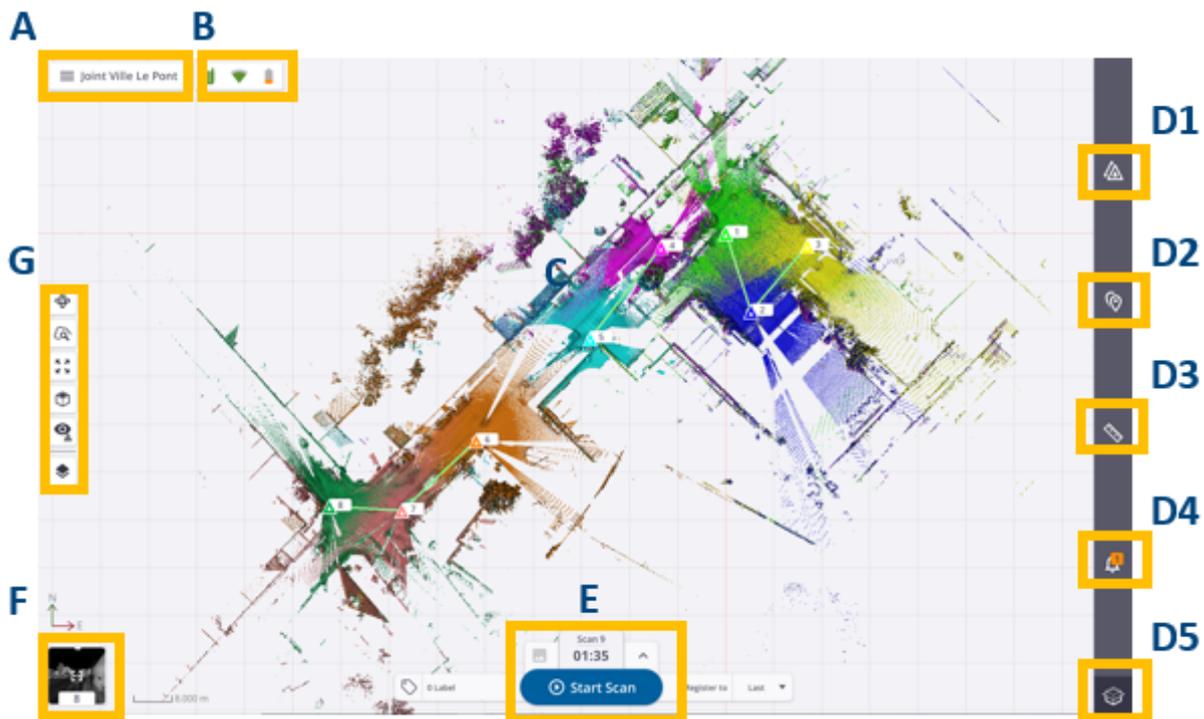
A - MENU / PROJECT NAME AREA is where the current project name displays and where you can access the **Menu** panel.

B - SCANNER STATUS AREA is where you can visually check the connection status of the scanner, the type of connection set between the scanner and the controller, the battery level in the scanner, and the atmospheric correction applied*. Click inside this area to open a window and access more detailed information such as the scanner name and the reference number, the space left in the memory card, the Wi-Fi settings, the atmospheric correction value*, and the power level left in the scanner. From this new area, you can access to the **Connections** panel (see Connect to a Scanner), to the **Settings** pages (see Settings), to the **Wi-Fi Advanced Settings** panel (see Define Advanced Wi-Fi Settings) and to the **Configure Atmospheric Correction** panel* (see Apply Atmospheric Corrections).

C - VIEW AREA is where the collected data displays. See Views.

D - TOOLS AREA is where you can access the available tools.

- **D1 -** ⚠ **Stations List** opens a panel from which you access the captured data to view detailed information, run additional task(s). See Stations List Panel.
- **D2 -** ◎ **Points Tool** enables you to add and edit annotations and precision points. See Points Tool.

- **D3** - ✎ **Measurement Tool** enables you to measure position(s), distance(s) and area(s) or a surface. See Measurement Tool.

- **D4** - 🔔 **Notifications List** opens a panel from which you access all notifications popped-up during a working session. A notification can state a connection status of the scanner, a warning on the battery charge level in the scanner, one of the numerous steps the scanner executes, etc. See Notifications List Panel.

- **D5** - ⬡ **Limit Box** enables you to clip and export a region on the displayed point cloud to the LAS format. See Limit Box.

E - **SCAN & IMAGE PARAMETERS AREA** is where you access the acquisition parameters, launch a scan, and / or add labels. It is available at all times when the software opens and the controller is connected to the scanner.

F - **VIEW TOGGLE AREA** is a shortcut to switch from the current view to another view.

G - **DISPLAY SETTING S AREA** is where you can access the display, rendering and navigation options. It is available at all times. The number of options varies depending on the view.

> **NOTE –** (*) Only for an X9 and when the **Atmospheric Corrections** option has been turned ON.

Views

🗺 **Map View**: This view is where the captured scan data displays locked in 2D and from the **Top View** (see Map View).
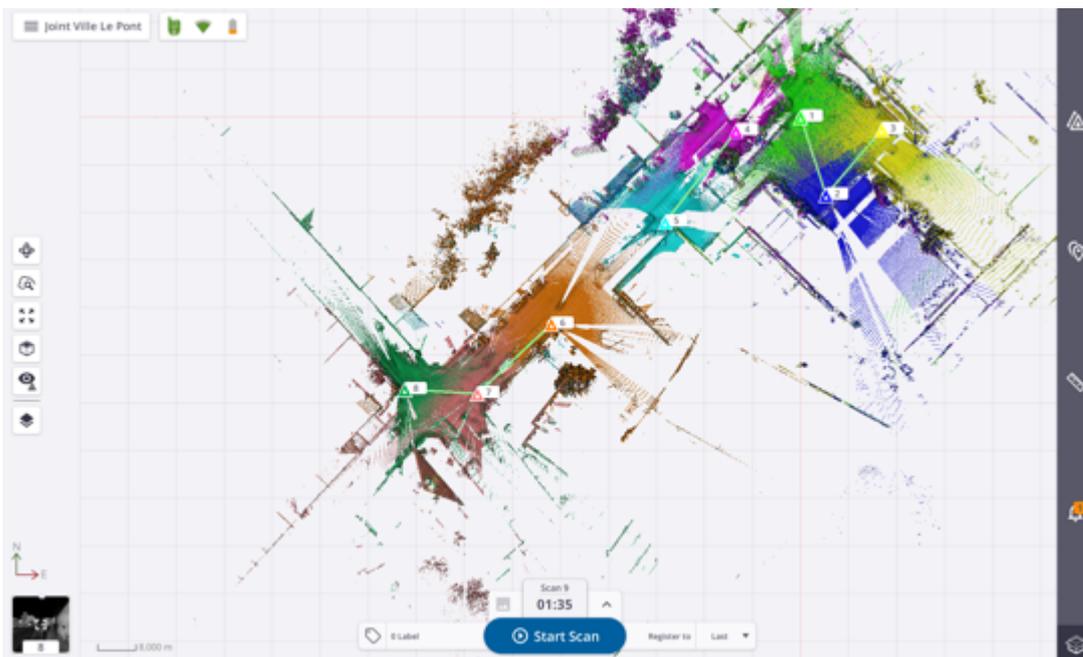
🖼 **STATION VIEW**: This view is where the captured scan data displays as a 2D spherical luminance (or colored) image (see Station View).

⊕ **3D View**: This view is where the captured scan data displays free of the 2D lock (see 3D View).
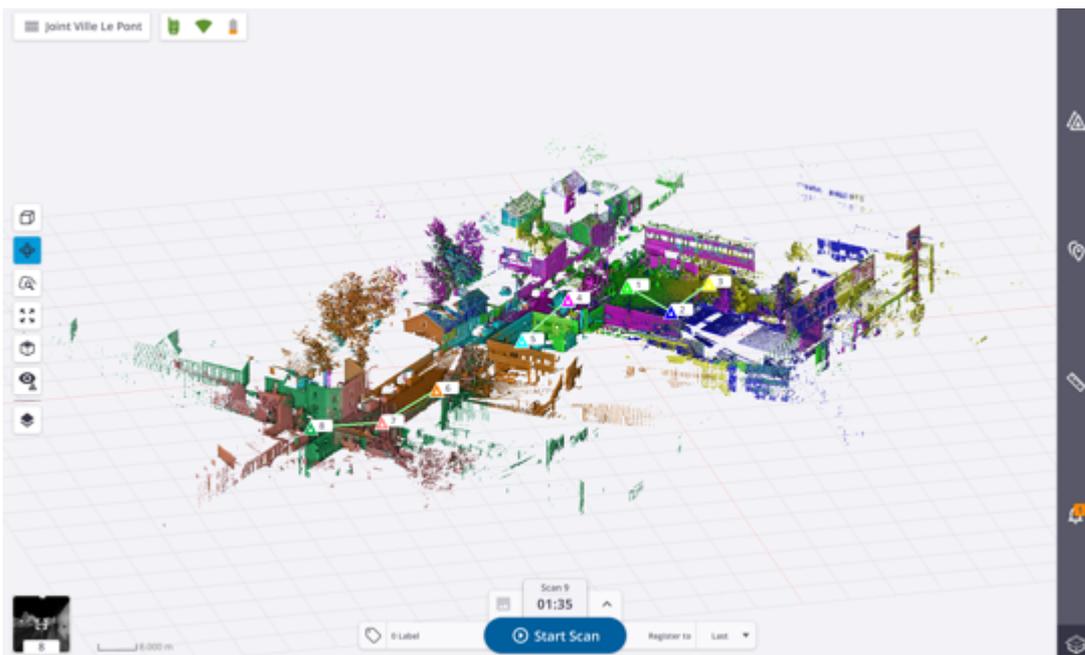
Panels

MENU PANEL: This panel populates the application options. Tap ☰ **Menu** to display the panel.
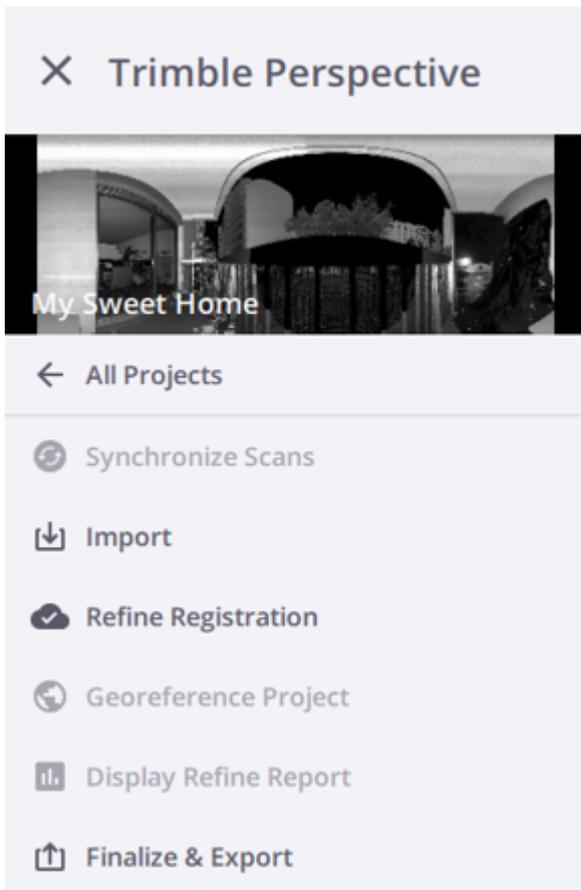
STATIONS LIST PANEL: All the data captured during a site job are organized in this panel (see Manage Stations). Tap ⚠ **Stations List** to display the panel.
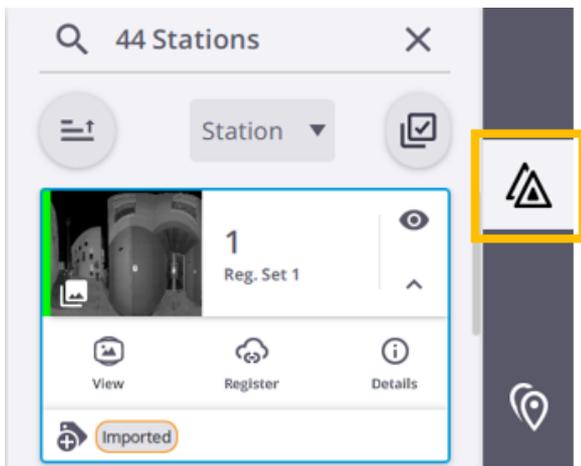
NOTIFICATIONS LIST PANEL: This panel displays a chronological top-down view of all activities happening during your working session. Tap 🔔 **Notifications List** to display the panel.

All activities you run or the application runs are recorded, and each activity displays as a **Notification**. Use this list of notifications to chronologically follow the flux of activities. The number above the **Notifications List** icon indicates the number of unread notifications. This number drops to zero once the **Notifications List** panel is opened. For each notification, you can see how long the notification has appeared or expand the notification to view the details (see Notifications).
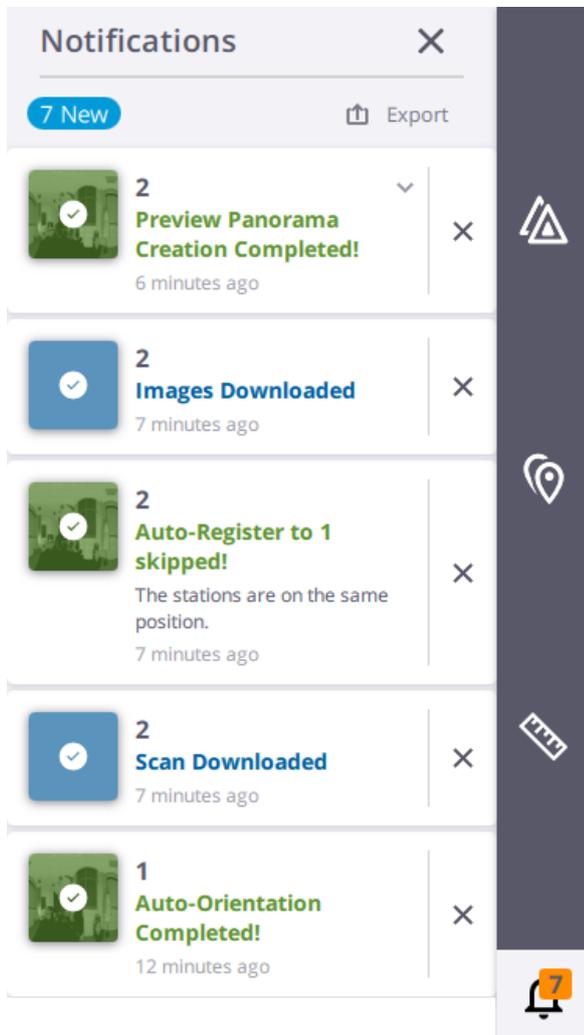
Keyboard Shortcuts

When you run Trimble Perspective on a Windows desktop (or laptop), you can use the following keyboard shortcuts:

- **Ctrl** + **A** - Select all text
- **Ctrl** + **C** - Copy text
- **Ctrl** + **V** - Paste text
- **Ctrl** + **Z** - Undo

- **Ctrl** + **Y** - Redo
- **Tab** - Indent
- **Enter** - Accept / Yes
- **Esc** - Exit / No
- **Delete** - Delete the selected item
- **F1** - Open the Help file

Settings

Access the application **Settings** by tapping ☰ **Menu** > ⚙ **Settings**.

> **NOTE -** ⚙ **System Logs** enables you to generate log files that may be requested by Trimble Support in order to help troubleshoot issues with either the software or the scanner. Log files can contain non-ASCII characters. You need to be connected to your scanner. Otherwise, all the instrument log files will be missing.

General
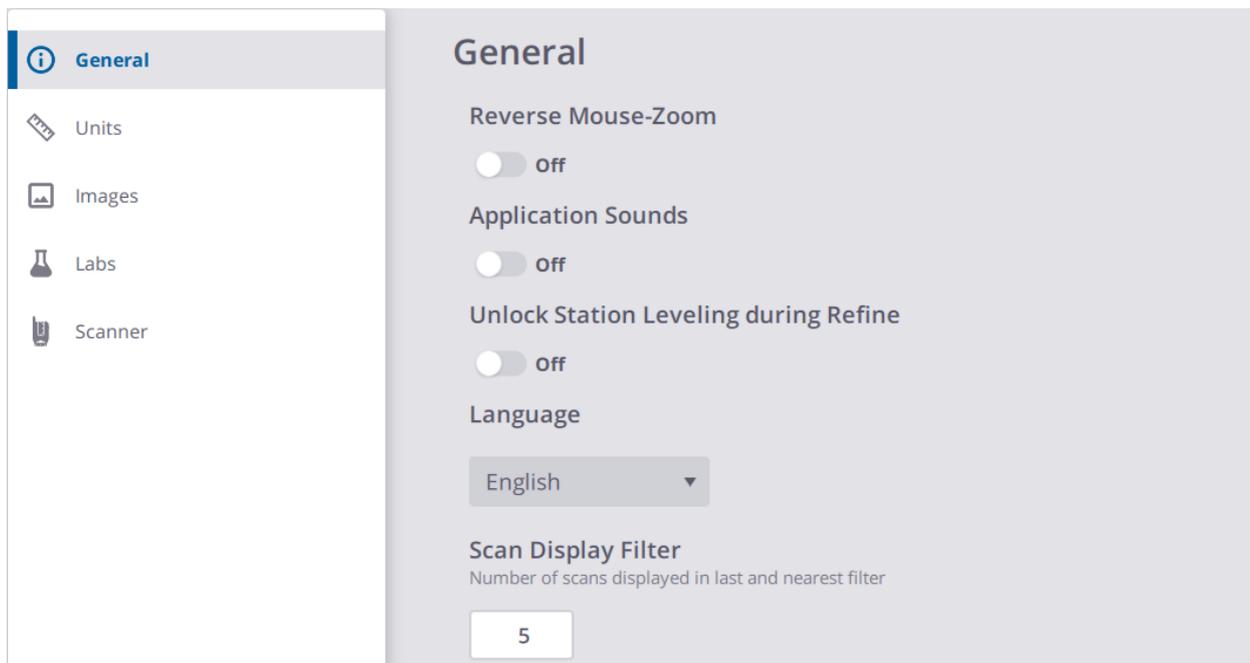
REVERSE MOUSE-ZOOM: Keep the default behavior **Off** (Roll forward to zoom in / Roll backward to zoom out) or change to **On** (Roll forward to zoom out / Roll backward to zoom in) when using a mouse wheel instead of the touchscreen.

APPLICATION SOUNDS: Turn the option **On** to activate (or **Off** to deactivate) the sound notifications.

UNLOCK STATION LEVELING DURING REFINE: Turn the option On to unlock (or Off to lock) the leveling of leveled stations during **Refine Project**. See Refine a Project (or Registration Set(s)). This option is disabled (Off) by default.

LANGUAGE: This option enables you to choose the language of the application. Close and reopen the application to see the change applied.

SCANS DISPLAY FILTER: This option defines the number of scans to display when using the **Display Last** and **Display Nearest** options. See **Visualize Scan Data** > Map View.

Units

Use the **Units** settings to change project units, entry formats, and display formats for:
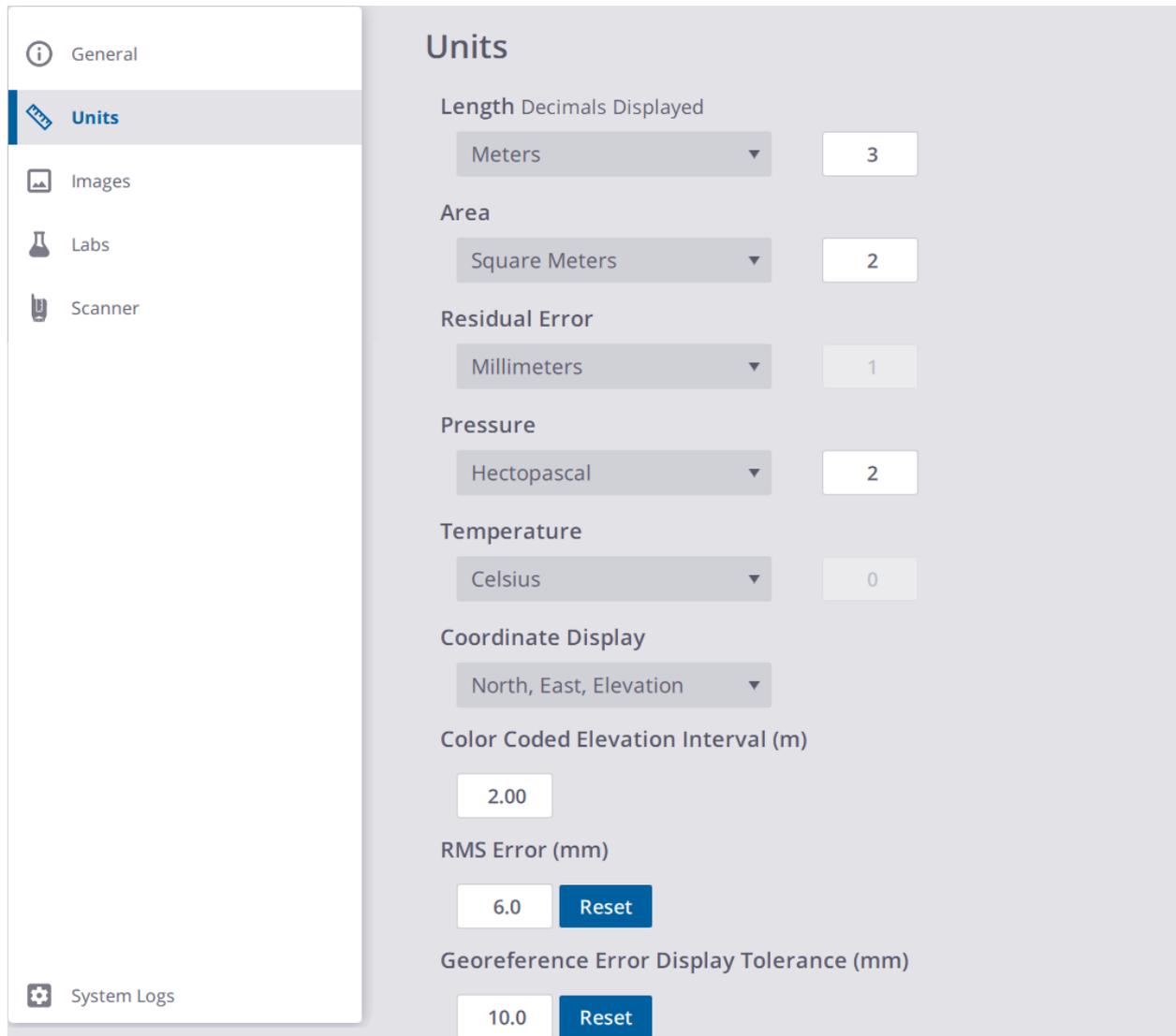
Units

Length Decimals Displayed

Meters ▼ | 3

Area

Square Meters ▼ | 2

Residual Error

Millimeters ▼ | 1

Pressure

Hectopascal ▼ | 2

Temperature

Celsius ▼ | 0

Coordinate Display

North, East, Elevation ▼

Color Coded Elevation Interval (m)

2.00

RMS Error (mm)

6.0 Reset

Georeference Error Display Tolerance (mm)

10.0 Reset

Sidebar navigation: General, **Units**, Images, Labs, Scanner, System Logs

LENGTH: Select whether to work in Metric or Imperial units. If Feet, specify whether they are US Survey Feet or International Feet.

AREA: Select whether to work in Metric or Imperial units.

RESIDUAL ERROR: Select whether to work in Millimeters, US Survey Feet or International Feet.

PRESSURE: Select whether to work in Millibar, Hectopascal, Milliliter of Mercury or Inch of Mercury for displaying atmospheric correction values (for an X9 only).

TEMPERATURE: Select whether to work in Celsius or Fahrenheit for displaying atmospheric correction values (for an X9 only).

COORDINATE DISPLAY: Select whether to work in the (X,Y,Z) coordinate system or in the (N,E,El) coordinate system.

COLOR CODED ELEVATION INTERVAL (m): This number defines an interval in meters when applying the **Color Coded Elevation** rendering to the data displayed in the **Map View** (see **Visualize Scan Data** > Map View). The **Color Coded Elevation** renders the data with the height information encoded in the point color. This helps to visualize instantaneously the height of points in a scene. This rendering is useful to highlight e.g. in a building each floor separately, repeating the color bar at each level.

> **NOTE –** You need to be in the Right (or Left) view to see the **Color Coded Elevation** rendering applied.

RMS ERROR (mm): This is an adjustable threshold that is used when refining a project. See Refine a Project (or Registration Set(s)).

GEOREFERENCE ERROR DISPLAY TOLERANCE (mm): This is an adjustable threshold that is used when georeferencing a project. See Georeference a Project.

> **NOTE –** Only the **Metric** system is available when the application has been set to be used in the **Japan** region.

Labs
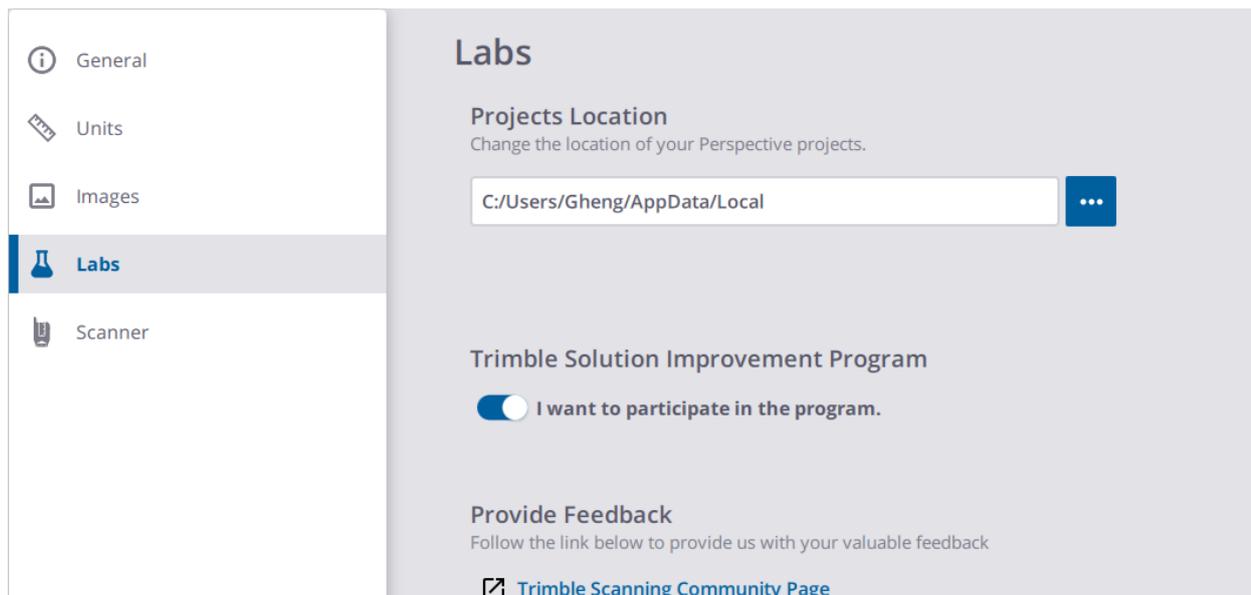
PROJECTS LOCATION: This option lets you define a path for the databases other than the default one created during the installation of Perspective. See Define Projects Path.

TRIMBLE SOLUTION IMPROVEMENT PROGRAM: This option lets you join the Trimble Solution Improvement Program to help Trimble improve the quality, reliability, and performance of this software.

PROVIDE FEEDBACK: Click the link to join the Trimble Community provided by Trimble Inc. to ask a question, share best practices, and get help from other users or Trimble experts.

Images

> **NOTE –** The settings in the **Images** panel are available only if you are connected to a scanner.

AUTOMATIC PANORAMA CREATION (PREVIEW): This option enables you to automatically create a panorama in preview quality with the captured images. See **Process Images** > Preview Quality.

X7 & **X9**
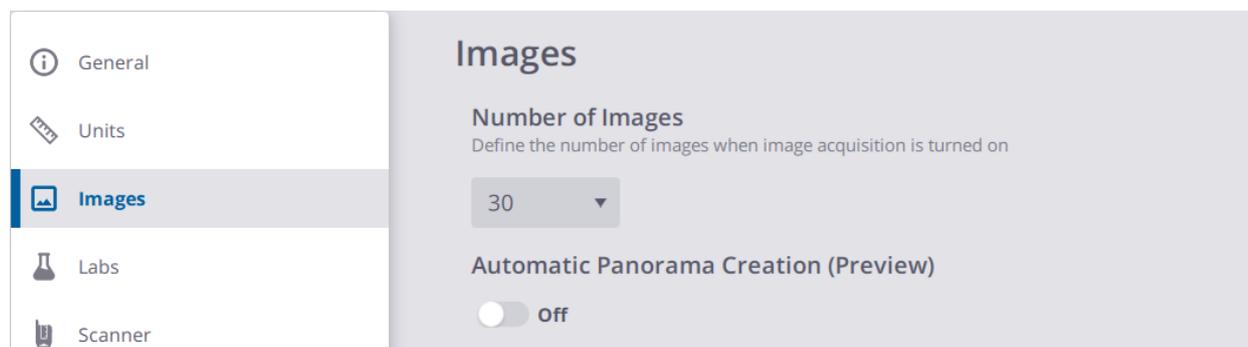
NUMBER OF IMAGES: This option enables the capture of 15 or 30 images.

- **15 Images** are recommended in simple environments where there are less occlusions to save time acquiring and processing images.

- **30 Images** are recommended in complex environments where occlusions are more prevalent and where more images will improve coloring and coverage when processed. However, the processing time will increase.

> **NOTE –** **+ 1 min** and **+ 2 min** are the durations to capture 15 images and 30 images. They must be added to the durations to capture a scan to have the total durations. See Define Image Parameters.
>
> | | |
> |---|---|
> | 15 | +1 min |
> | 30 | +2 min |

> **NOTE –** **+ 3 min** and **+ 6 min** are the durations to capture 15 images and 30 images with the **HDR** mode turned on. They must be added to the durations to capture a scan to have the total durations. See Define Image Parameters.
>
> | | |
> |---|---|
> | 15 | +3 min |
> | 30 | +6 min |

X12
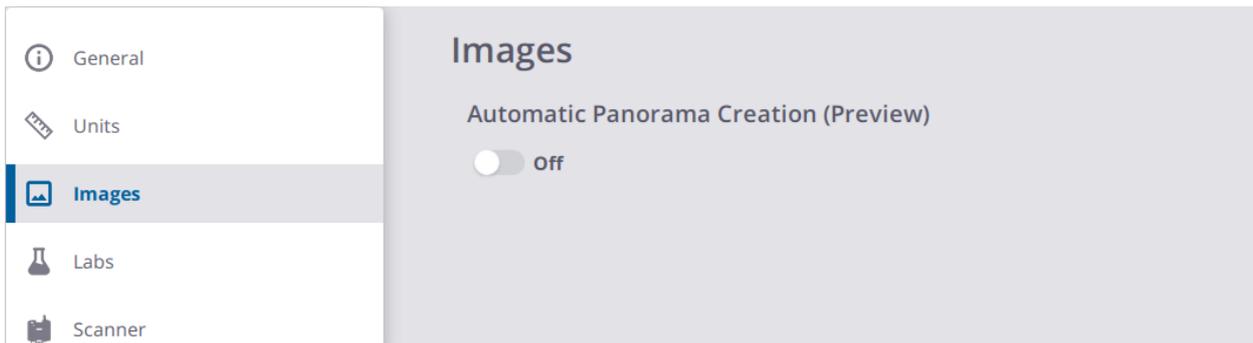
Scanner

> **NOTE –** The settings in the **Scanner** panel are available only if you are connected to a scanner.

X7

Scanner

Trimble X7
02119 | R2.5.100

USB	Battery	Storage	Report
	54 %	15 GB/30 GB	
		93 scan(s) left	

Advanced

Erase all scans   Diagnostic

Check Disk   Field Calibration

Format SD Card   Last Diagnostic

Last Calibration

Self-Leveling
Enable self-leveling before scanning

On

Instrument LED Color

On

Instrument LED Leveling guide color

On

Indoor Mode

Off
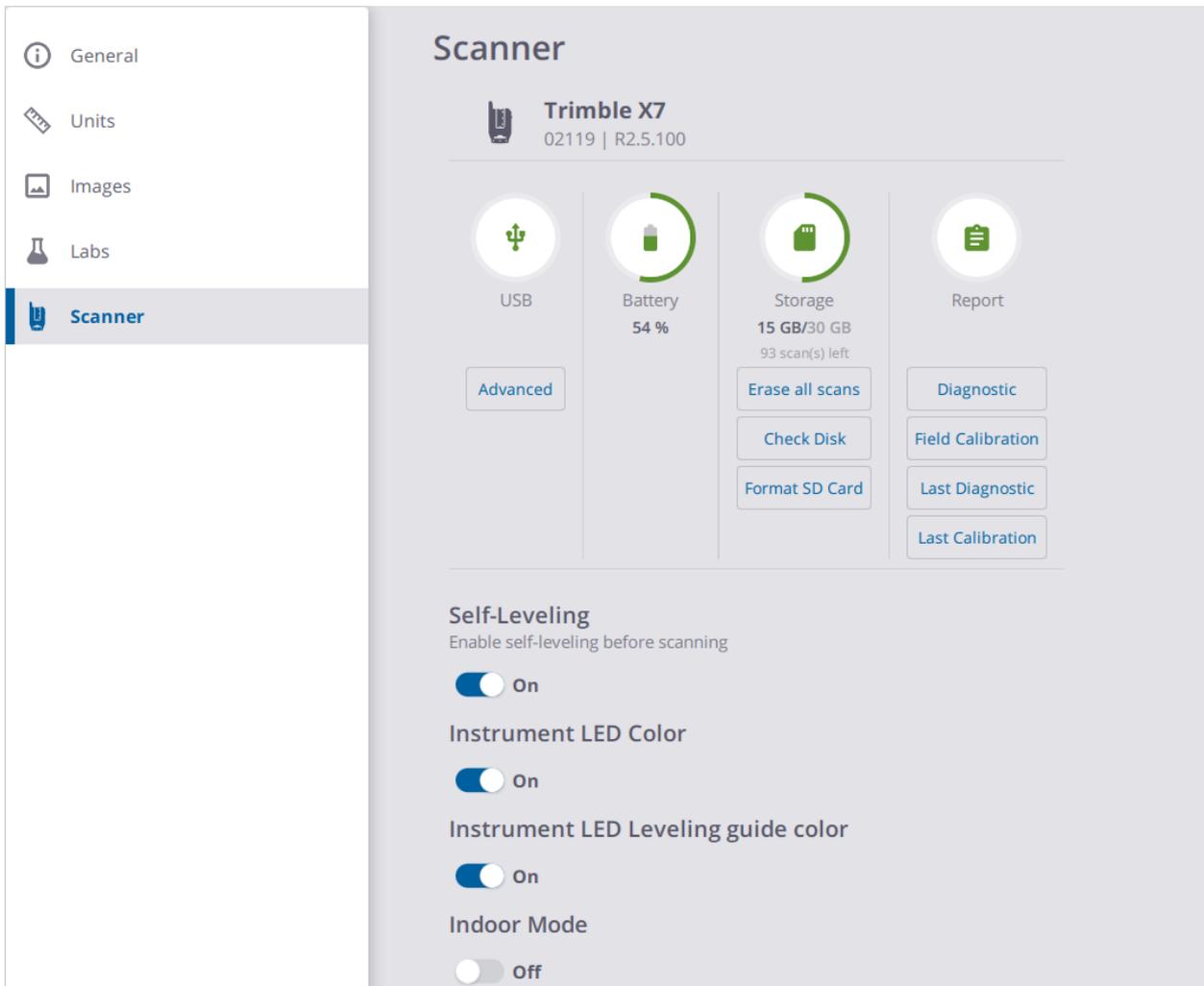
Wi-Fi: This panel displays the signal strength in percentage, the **Frequency Range** and the **Channel** in use in case of a wireless connection. Use the **Advanced** options to change the settings.

ADVANCED: This option lets you customize the **Frequency Range**, **Channel** and **Region Code** to use (see Define Advanced Wi-Fi Settings).

BATTERY: This panel displays the charge level of the battery in the scanner, in percentage and with color codes.

STORAGE: This panel displays the total capacity of the memory card in GB, the remaining storage capacity of the memory card in GB, and the number of allowable scans according to the current scan parameters. The **Storage** options are enabled only if a connection between the scanner and the controller has been set, and an SD card available in the scanner.

- **Erase All Scans**: This feature deletes all files in the **ScanData** folder on the memory card.
- **Check Disk**: This feature scans through the entire memory card to find and fix problems.
- **Format SD Card**: This feature deletes all files in the memory card.

> **NOTE –** When one of the three operations is being processed, the LEDs on the base of the scanner blink in orange.

> **CAUTION –** You cannot undo any of the operations.

DIAGNOSTIC: This feature consists in running a diagnostic to test each of the components in the scanner. The results display on a web page, and can be exported to the PDF or HTML format file (**Save**) and to the JSON format file (**Generate Support File**). Optionally, add a logo file to the report (**Edit**). See Diagnostic.

- **Diagnostic**: This feature runs a diagnostic on the scanner.
- **Last Diagnostic**: This feature opens the last run report (if available).

> **NOTE –**
>
> - A JSON format file is also created in the SD card.
> - The multi-color LEDs on the scanner blink orange when a diagnostic is run.

> **CAUTION –** You cannot run a diagnostic if the battery level of the scanner is below 10%

FIELD CALIBRATION: This feature consists in testing both the **Auto-Angular Calibration** and **Auto-Distance Calibration**. The results display on a web page, and can be exported to the PDF, or HTML format file (**Save**) and to the JSON format file (**Generate Support File**). Optionally, add a logo file to the report (**Edit**).

- **Field Calibration**: This feature runs a field calibration diagnostic on the scanner.
- **Last Calibration**: This feature opens the last run report (if available).

> **NOTE –** The multi-color LEDs on the scanner blink orange when a field calibration is run.

> **CAUTION –** You cannot run a field calibration if the battery level of the scanner is below 10%.

SELF-LEVELING: This feature consists in measuring the horizontality (or vertical) of the scanner.

> **CAUTION –** If you disable the **Self-Leveling** feature, you will not be able to register scans accurately and the scanner will not be able to perform area scanning (see Area).

INSTRUMENT LED COLOR: The feature turns off (or on) all the five LEDs at the base of the scanner.

> **NOTE –** The feature can be turned off (or on) when scanning.

INSTRUMENT LED LEVELING GUIDE COLOR: This feature helps you level the scanner by indicating which leg on the tripod needs adjusting. See Level a Scanner.

INDOOR MODE: This mode enables productivity gains by reducing the time to acquire each scan. Turn to **ON** to enable this mode. Note that this mode will:

- Limit the acquisition range to 30 meters.

- Reduce the steps taken to calibrate and level each scan, meaning that:

  Instead of measuring the **Tilt** at the beginning and at the end of each scan, the software will only measure at the beginning: a long measurement for the first scan and a short for the others.

  The Field Calibration will be done every hour of scanning, and after every scanner power cycle (restart of the scanner), or when the temperature will change significantly by +15 degrees (or by -15 degrees).

- Disable the following features: Precision Point, Laser Pointer and Area Scan.

X9

ATMOSPHERIC CORRECTION: The feature applies corrections to the distance measurement - expressed in PPM (Parts Per Million) - according to the atmospheric conditions.

> **CAUTION –** Turning the option off will reset to the default values (0, 1013.25 hPa and 20° Celsius respectively for the PPM, the pressure and the temperature).

INDOOR MODE: This mode is always **ON** and hidden. The Precision Point, Laser Pointer and Area Scan features are not disabled as with an X7 instrument when you activate the mode.

X12
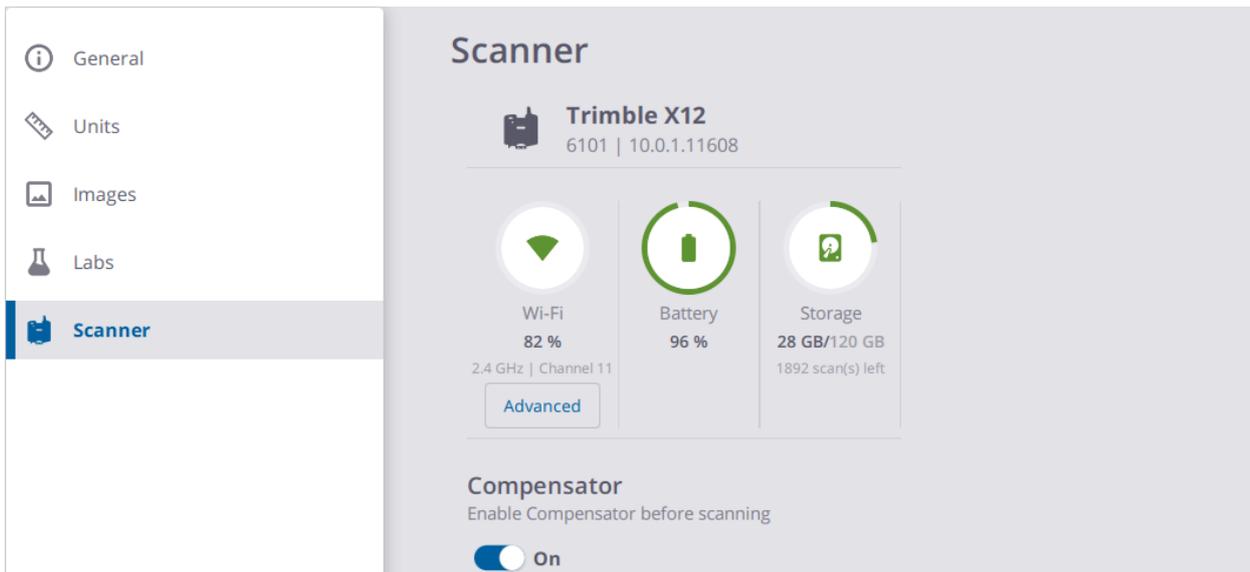
STORAGE: This panel displays the total capacity of the memory card in GB, the remaining storage capacity of the memory card in GB, and the number of allowable scans according to the current scan parameters. The **Storage** options are enabled only if a connection between the scanner and the controller has been set, and an SD card available in the scanner.

COMPENSATOR: The **Compensator** is a vertical compensation feature. It automatically level-compensates all 3D points when it is enabled. It is recommended to leave the **Compensator** on for the **Tilt** compensation when within a range of ±0.5°. The **Compensator** can be left on when scanning upside down or tilted at any angle but it will be out of range and the scans will be unleveled. The **Compensator** should be turned off when scanning on a fluctuating surface like a ship.

> **NOTE –** A scan acquired with the **Compensator** disabled will have the label "**Leveling Off**".

Notifications

When an activity is running, a notification pops up to show the progression, or when it ends. A notification has the colors described below, and each color corresponds to a status:

NO COLOR indicates an ongoing process.
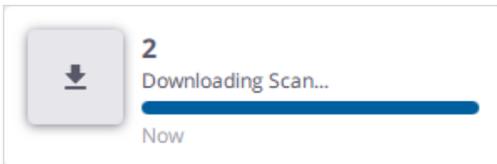
BLUE COLOR indicates a data download step that has been executed with success.
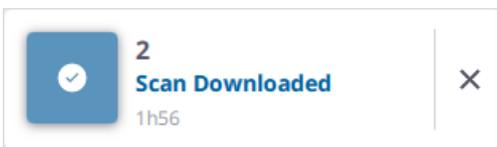
GREEN COLOR indicates that a process has been executed with success.
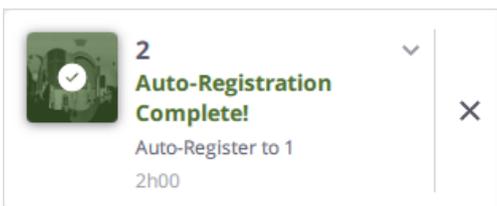
ORANGE COLOR indicates a warning.
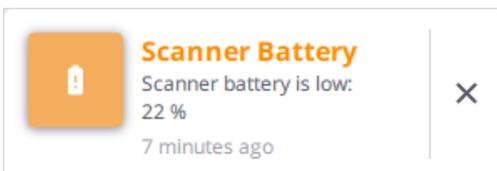
RED COLOR indicates that a process has failed.
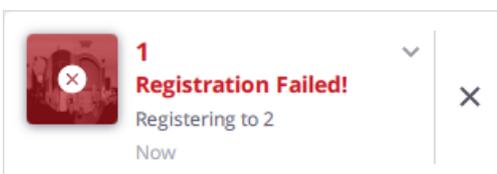
All popped-up notifications are automatically saved. When you reload a project, notifications are automatically reloaded by a batch of ten in the same order as they were initially generated:

- To load all notifications, tap **Show All**.
- To export all the notifications into a **CSV** format file, tap **Export**.

> **NOTE –** The number of all new notifications (compared to the last record) displays at the top left corner of the panel.

5

Manage Projects

After starting the software, create a new project, load and edit an existing one, import one, and merge two projects together.

Create a New Project

After starting Perspective, when there is:

- No project, tap ➕ **Create New**.

- At least a project, tap **All Projects** from the **Menu** panel and choose ➕ **New**.

A project has the following attributes:

- **PROJECT NAME**: A default name is used if nothing is entered. The entered name cannot contain any of the following characters: \/:*?"<>|.

- **PROJECT PHOTO**: To illustrate a project, take a picture with the controller (📷 **Take Photo**) or choose an existing picture (📁 **Choose Existing**). See Illustrate With a Picture.

- **START INDEX**: The default starting index value for the first scan to scan is 1. It becomes unmodifiable once defined.

- **PROJECT DESCRIPTION**: The default values for this field are the date, time and user name. You can see these values when editing a project. See Edit a Project.

> **NOTE –** The ➕ **Create** button remains disabled until you define a valid start index (between 1 and 999999).

The **Map View** opens. The created project name displays next to the **Menu** icon. The 🔻 **Disconnection** icon in red means it is not yet connected. See Connect to a Scanner.

Perspective saves the project to the database on the controller in the default folder "C:\users\username\AppData\Local\Trimble Perspective DB", and:

- **X7** & **X9** - Under the **ScanData** folder on the memory card of the scanner (only if the controller is connected to the scanner).

- **X12** - To the internal drive of the scanner (only if the controller is connected to the scanner and after acquiring a scan).

> **NOTE –** You can define a path for the databases other than the default one created. See Define Projects Path.

> **TIP –** To add a new project, tap **All Projects** from the **Menu** panel, and choose **+ New** from the **Projects** page.

> **NOTE –** The added picture and comment are not taken into account by the on-board application of the X12 scanner.

Load a Project

Perspective loads automatically the most recently opened project. To load another project, tap **All Projects** from the **Menu** panel. From the opened **Projects** page, tap a project thumbnail.

Define Projects Path

During the installation, Perspective creates a database with a default path "C:\users\username\AppData\Local\Trimble Perspective DB" on your controller to store and save the projects.

On start-up, Perspective attempts to establish a communication with the database's server and displays the "**Database Not Connected**" message during this time.

Once the communication is established, the message changes to "**Database Not Loaded**", and Perspective loads either:

- The default database (if no change has been done since the installation).

- Or the last used database (if it has been changed).

Once the database is loaded, Perspective opens the last project used on the database. If no project has been used or Perspective has been closed on the **Project Browser** no project is loaded.

Tap ☰ **Menu** > ⚙ **Settings** > ⚗ **Labs** . With the **Labs** page open, tap ••• **Select File Path** to:

- Create a database on a different location.

- Select the database to use. Note that changing the database location moves all the projects to the new location.

> **NOTE –** Make sure to:
>
> - Have permissions to write to a directory.
>
> - Not use invalid characters (not Latin ones, and emoticon).
>
> - Not use an external drive.

Import a Project (or a Scan)

Project

Use [↓] to import a project file in the **TDX** format (Trimble Data eXchange file format). Such a project contains data already processed (registered, colorized, etc.).

After starting Perspective:

- No project is loaded: Tap **Import Project** to import a TDX project file as a new project. The start index will be the lowest index of the imported project.

- A project is already loaded:

  ○ Tap **All Projects** from the **Menu** panel, and choose **Import** to import a TDX project file as a new project. The start index will be the lowest index of the imported project.

  ○ Tap **Import** from the **Menu** panel to import a TDX project file into the opened project. Define the start index. If the defined value is:

    ■ Less than (or equal to) the last station of the opened project, the start index of the imported project will be the last station with an increment of the opened project.

    ■ Greater than the last station of the opened project, this value will be used as the start index of the imported project.

> **TIP –** The TDX format enables sharing data already processed between users. Export first the project (see **Export a Project** > TDX) and import it.

> **NOTE –** When you import a georeferenced project in TDX format into Trimble Perspective, all the georeferencing errors are recomputed during the import process. Once this process is complete, the project will be marked as "Georeferenced".

Scan

Use [↓] to import a scan file into an opened project. Such a scan file contains raw data. It will be named using an index. Choose to use the next index of the opened project or define a new one for the first scan.

Tap **Import** from the **Menu** panel and choose as **File Type:**

- **TZF files (*.tzf)** for X7 & X9 scanner scan files.

- **TOS files (*tos)** for X12 scanner scan files. Perspective uploads to the database:

  ○ All the selected TOS format files, and converts them to the TZF format.

  ○ All the related image files (TOI).

> **CAUTION –** Perspective does not allow you to import an isolated area scan file (without a parent station). Trying doing so will display a warning notification.

- **TDX files (*.tdx)** for a project file in the TDX format (Trimble Data eXchange file format).

  > **NOTE –** Only TDX format files generated by Perspective can be imported.

For each new scan file imported, Perspective generates the displayed point cloud. This can take time if the number of imported scans is high.

> **NOTE –** Scans will be labeled as **"Imported"** once imported into a project.

Display Project Properties

Tap **All Projects** from the **Menu** panel. The **Projects** page displays all available projects, each as a thumbnail. In addition to the project name and the time-stamp information, each thumbnail contains the followings:
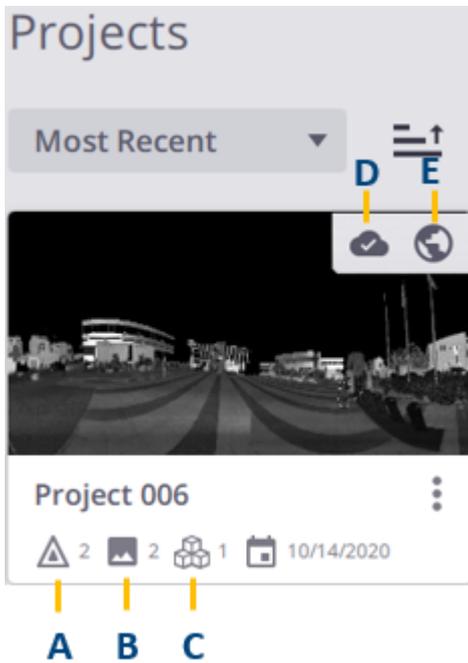
- **A** - Number of stations (see Manage Stations).
- **B** - Number of panoramas (see Create Panoramas).
- **C** - Number of registration sets (see Edit and Register Registration Sets).
- **D** - If the project has been refined (see Refine a Project (or Registration Set(s)).
- **E** - If the project has been georeferenced (see Georeference a Project).

Edit a Project

First, open the **Projects** page by tapping **All Projects** from the **Menu** panel.
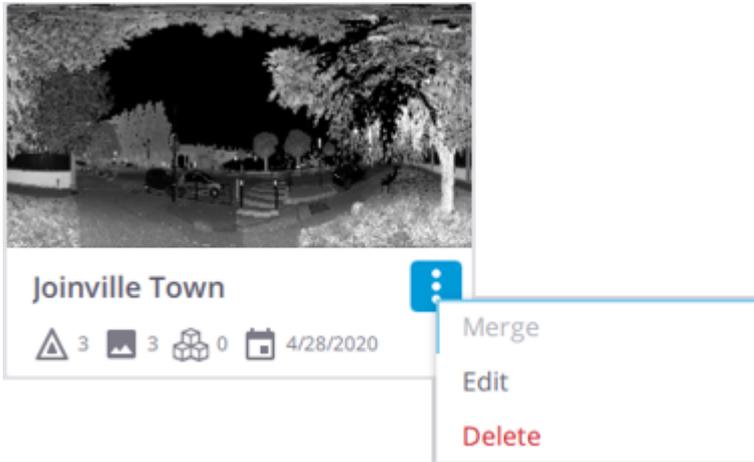
Update

Tap ⋮ **More** and **Edit** from a project thumbnail to change the attached picture, to modify the added comment, or to change the project name.

> **NOTE –** The project will be renamed:
>
> - On the application (database) and on the memory card under the ScanData folder (X7/X9) or on the scanner internal memory (X12), if you are connected to the scanner.
>
> - Only on the application (database) if you are not connected to the scanner. The project will be renamed at the reconnection.

> **CAUTION –** A project will not be renamed in Perspective when you rename the project from the on-board application of the X12.

Delete

To delete a project, tap ⋮ **More** and **Delete** from a project thumbnail.

To delete several projects, tap ✏ **Select** and choose the projects to delete or tap ☑ to select all. Tap 🗑 **Delete**. Perspective deletes:

- The selected project(s), and any associated project files from the database:

  X7 & **X9** - TZF, and/or TCF, and/or TPF.

X12 - TZF, and/or TOI, and/or TPF.

- And all related project files:

    X7 & **X9** - TZF, and/or TCF from the ScanData folder in the memory card.

    X12 - TOS, and/or TOI from the scanner's internal memory.

    > **NOTE –** Only if the **Delete from Scanner** option has been chosen, and the scanner is connected to the controller.

> **NOTE –** To delete a station from a project, see Manage Stations.

Sort

You can sort the projects by name (**Alphabetical**), by the last opened ones (**Most Recent**), by number of captured data (**Number of Stations** and **Number of Images**), by creation date (**Date Created**), in **Ascending Order** (or **Descending Order**).
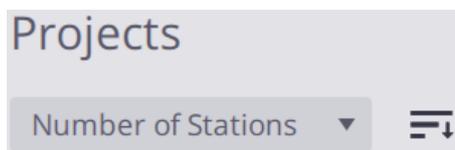
Merge Projects

> **NOTE –** The **Merge** feature is enabled only if there are at least two projects.

Open the **Projects** page by tapping **All Projects** from the **Menu** panel.
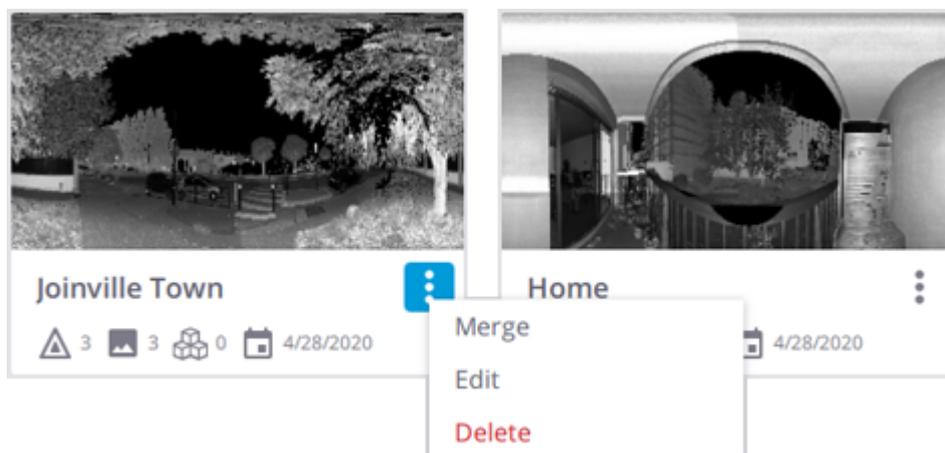
Select a project (**A**) by tapping ⋮ **More** and **Merge**. Select a project (**B**) (or more) to merge with the selected project (**A**) and tap **Merge** again. The following is imported into the selected project (**A**):

- **SCANS**: Scans and attributes (name, captured and processed images, labels, and colorization). Define the start index. If the defined value is:
    - Less than (or equal to) the last station of project **A**, the start index of project **B** will be the last station with an increment of project **A**.
    - Greater than the last station of project **A**, this value will be used as the start index of project **B**.
- **REGISTRATION SETS**: Registration sets are renamed to follow the registration set(s) (if existed) of the current project.
- **ANNOTATIONS & PRECISION POINTS**: Annotations or precision points with attributes (position, name, description, and attached image). In case of conflict, annotations or precision points are renamed following the following pattern "Annotation_Name (n) and "n" the number of annotations or precision points with the same name.
- **PROJECT FILES**: TZF, and/or TCF (X7/X9), and/or TOI (X12) and/or TPF only to the database.

The following will not be imported into the selected project:

- **PROJECT ATTRIBUTES**: Project's name, illustration image, and description.
- **PROJECT COORDINATES FRAME**: Scans are imported into the current project coordinates frame.
- **NOTIFICATIONS** : Notification history is not imported.

> **NOTE –**
>
> - You cannot merge two empty projects together.
>
> - Perspective checks if there is enough space on the disk. If not, a warning pops up and the merging is canceled.

The **Merge** and **Import** features are similar. Scans are labeled as **"Merged"** in case of merging projects or **"Imported"** when importing a project.

6

Connect, Capture & Synchronize

After loading a project in the software, connect your controller to a scanner to start collecting data. Optionally, define the settings before or use the default ones.

Connect to a Scanner

Connect a controller to a scanner:

- **X7** & **X9** - With Wi-Fi or with the provided USB 2.0 cable. Only one connection type can be used at a time. The USB cable is automatically selected as the primary connection type.

  After powering a scanner on, the five LEDs at its base blink orange (the scanner is initializing) and become:

  - White when no valid license has been found. Perspective displays a warning and prompts you to purchase a license.

  - Green when a valid license has been found and the scanner is ready to go on.

  For the first connection to the scanner, Perspective prompts you to set a Wi-Fi password (see Set Wi-Fi Password). Once set, the next time you reconnect to the scanner with:

  - The same controller, the connection is automatic and does not require entering the Wi-Fi password.

  - A different controller, enter the Wi-Fi password that has been set to the scanner.

    If you know the Wi-Fi password, enter it and tap **Connect**.

    If you do not know the Wi-Fi password or if you forgot it, reset it (see Reset Wi-Fi Password).

- **X12** - With Wi-Fi or with the provided RJ45 Ethernet cable. Only one connection type can be used at a time. The RJ45 Ethernet cable is automatically selected as the primary connection type.

  > **NOTE -** After powering the scanner on, wait until it is ready. This can take about 20 seconds. Do not touch the screen in the meanwhile. The start-up is complete after an audible sound and the menu appears on the display. Refer to the Trimble X12 3D Laser Scanner User Guide for more information.

  At the first power-up of the scanner, you are prompted to enter a Wi-Fi password on the on-board user interface for security. For the first Wi-Fi connection to the scanner, Perspective prompts to enter the Wi-Fi password. The next time you reconnect to the scanner with the Wi-Fi using:

  - With the same controller, the connection is automatic and does not require the Wi-Fi password.

  - A different controller, enter the Wi-Fi password that has been set to the scanner.

  > **TIP -** To find out the Wi-Fi password that has been set to the scanner, first tap ⚙ **Settings** > **Connections** > **Edit Settings** from the on-board application of the scanner. Then, tap in the **Wi-Fi password** field to display the **Wi-Fi password** screen. Finally, tap 👁.

With Wi-Fi

1. Tap 📶 to open the **Connections** panel.

   All the scanners in the vicinity of the controller appear in the **Available** list. If you have previously connected to a scanner, it is listed above in a separate list titled **Previously Connected**.
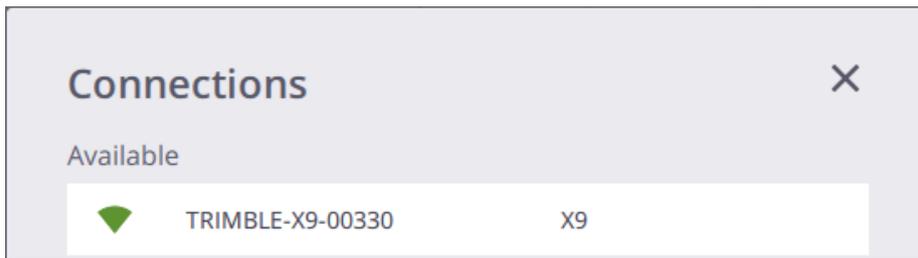
2. Tap a scanner name to connect to the scanner. The chosen scanner appears in the **Connected** list.
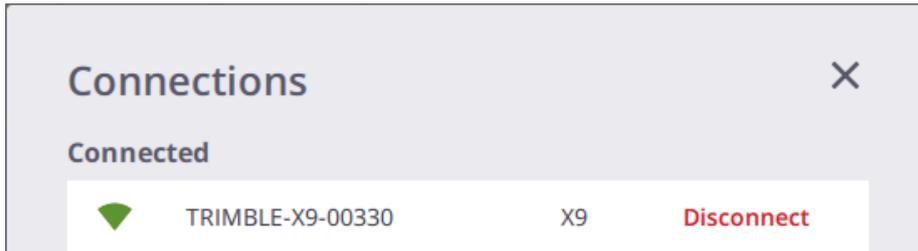
3. Optionally, tap **Disconnect** and choose another scanner to connect.
4. Tap ✕.

With Cable

-   **X7** & **X9** - Use the approved cable P/N 53099032 for connecting to the scanner. This Hirose 6P-PC to USB 2.0 cable has been designed for high-speed data transfer. The scanner powers On automatically after the controller is switched on.

-   **X12** - Use the approved RJ45 Ethernet cable for connecting to the scanner.

> **NOTE –** When you are connected to a scanner with a cable, you cannot switch to the wireless connection with the same scanner. Disconnect first the cable from the scanner, and the software reconnects automatically to it in wireless.

Once connected, Perspective checks for the atmospheric correction set for the scanner (only an X9 and if the **Atmospheric Correction** option has been enabled in ⚙ **Settings > Scanner**), and prompts to define a new value or to use the value of the scanner if it does not match the value used in Perspective (see Apply Atmospheric Corrections)

At the same time, a notification pops up and the **Scanner**, **Connection** and **Scanner Battery** icons are displayed:
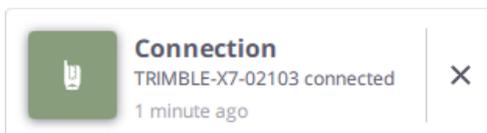
- **X7** - **Scanner** (A), **Wireless Signal** (B1) (wireless connection), or **USB Connector** (B1) (cable connection)), and **Scanner Battery** (C).

- **X9** - **Scanner** (A), **Wireless Signal** (B1) (wireless connection), or **Rj45 Ethernet Connector** (B2) (cable connection)) **Scanner Battery** (C), and **Atmospheric Corrections** (D).

> **CAUTION –** You will be disconnected from your scanner if the firmware version is not up to date compared to the release version of the software. Use Trimble Installation Manager for Windows to update your scanner firmware. For more information, refer to the Trimble X7/X9 3D laser scanner's user guide.

- **X12** - **Scanner** (A), **Wireless Signal** (B1) (wireless connection), or **Rj45 Ethernet Connector** (B2) (cable connection)) and **Scanner Battery** (C).

Tap any icon to open the **Scanner** panel. It displays the following information:

- Scanner in use (name, configuration (**Core** or **Premium**) for X9 only, reference number and firmware version).
- Scanner battery's charge level.
- Storage space left in the memory card.
- W-Fi settings (**Frequency Range**, **Channel** and **Signal Strength** in percentage).

In the **Scanner** panel, tap:

- **X7** & **X12**
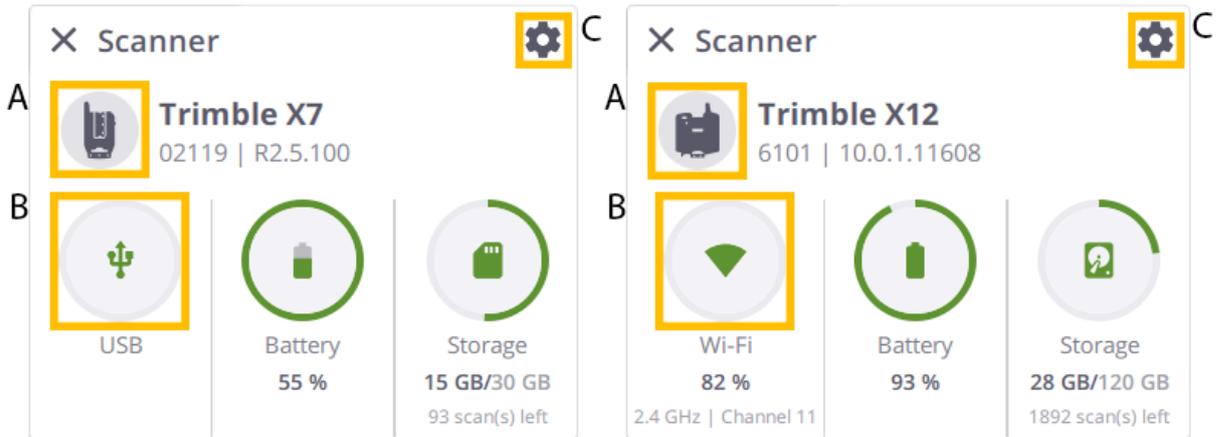
- **A -** The **scanner** icon to open the **Connections** panel.

- **B -** The **Wireless Signal** (or **USB Connector**, or **RJ45 Ethernet Connector**) to open the **Wi-Fi Advanced Settings** panel (see Define Advanced Wi-Fi Settings).

- **C -** The **Settings** icon to open the **Settings** panel (see ⚙ **Settings** > Scanner).

- **X9**
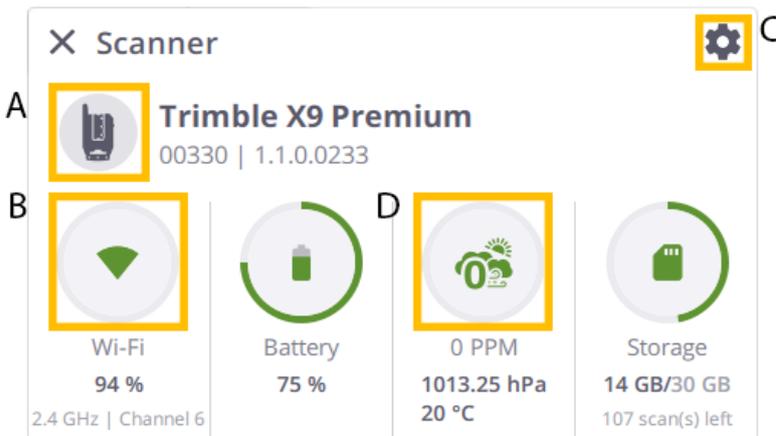
D - The **Atmospheric Correction** icon to open the **Configure Atmospheric Corrections** panel (see Apply Atmospheric Corrections).

The **Start Scan** button displays in the **Map View** and a station is automatically created:

- The first station if the loaded project is new.

- The next station if the loaded project already contains some stations.

A **Station** is typically a scanning position from which you capture a 360° scan (**Full Dome**) and a series of scans on a specific area of interest (**Area**).

From now, you are ready to scan with the default parameters (see Capture Scans), or you can level the scanner (see Level a Scanner) and/or define the scan and image parameters (see Define Scan Parameters and Define Image Parameters) instead.

X7 & **X9** - You can connect two controllers (a tablet with Trimble Perspective and an Android (or iOS) phone with Trimble Perspective Mobile) at the same time to a scanner via **Wi-Fi**. Refer to the Trimble Perspective Mobile user manual for connecting an Android or iOS phone. Use both controllers to control and capture the data. See Hybrid Workflow to Capture the Data.

Set, Update and Reset Wi-Fi password

A Wi-Fi password is required to connect to a scanner for security reasons.

Set

A Wi-Fi password should contain only ASCII characters. It must be between 8 and 63 characters long, and must contain at least one number and one special symbol.

> **TIP –** You can select (**Ctrl** + **A**), copy (**Ctrl** + **C**) and paste (**Ctrl** + **V**) a Wi-Fi password.

Update

> **NOTE –** You must be connected to the scanner with Wi-Fi, or with USB cable or with RJ45 Ethernet cable to update the Wi-Fi password.

Tap ≡ **Menu** > ⚙ **Settings** > **Scanner** > **Advanced** to open the **Wi-Fi Advanced Settings** panel and tap **Change** to update the current Wi-Fi password.

Reset

- **X7** & **X9** - To reset the Wi-Fi password to the factory default value, press the **On/Off** button on the scanner for twenty seconds. You will hear a first beep followed by three consecutive beeps after ten seconds and five consecutive beeps after ten more seconds. Release the **On/Off** key after hearing the five consecutive beeps to complete the reset.

  The controller will be disconnected and reconnected automatically to the scanner and Perspective will prompt you to define a new Wi-Fi password. Your new Wi-Fi password should contain only ASCII characters. It must be between 8 and 63 characters long, and must contain at least one number and one special symbol.

  > **NOTE –** You can be connected to the scanner with Wi-Fi or with USB to reset the Wi-Fi password.

> **NOTE –** If the same controller was connected to the same instrument before, please **Forget** this scanner in the controller's **Network and Internet** settings in **Windows**.
>
>
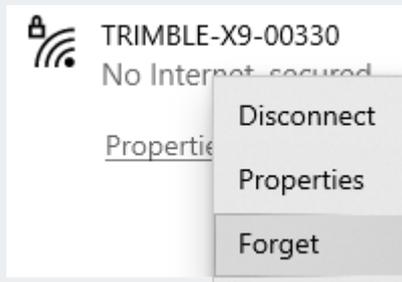
- **X12** - To reset the Wi-Fi password, tap ⚙ **Settings** > **Connections** > **Edit Settings** from the on-board application of the scanner.

  > **NOTE –** Refer to the Trimble X12 3D Laser Scanner user guide for instructions.

Apply Atmospheric Corrections

The X9 scanner uses the EDM (Electronic Distance Measurement) technology to collect points. A distance measurement is function of the velocity of light in the atmosphere and the velocity of light depends on the refractive index of air, temperature, pressure, and humidity. The **Atmospheric Correction** feature applies corrections to the distance measurement - expressed in PPM (Parts Per Million) - according to the atmospheric conditions. The default PPM value is zero.

Connect Perspective to a scanner. The **Atmospheric Correction** option in the ⚙ **Settings** > Scanner panel is:

Off

The scanner has an atmospheric correction set which is:

- Equal to zero. All scans will be captured without any atmospheric correction being applied.
  - Turn the option **On**. The **Configure Atmospheric Corrections** panel opens:

  - Define an atmospheric correction value.
    1. Enter a pressure and a temperature and press **Enter**. The PPM value is automatically computed.

2. Or enter a PPM value and press **Enter**. As the pressure and the temperature cannot be deduced from the PPM, Perspective displays them as "---".

3. Optionally, use ↺ to restore the previously saved PPM value.

> **NOTE –** If the input value is out of range, the corresponding field is surrounded in red:
>
> - Pressure: 500 mbar to 3500 mbar.
>
> - Temperature: -20° Celsius to 50° Celsius.
>
> - PPM: -809 to 151.

4. Tap **Save**.

- Alternatively, tap ✕ to disable the correction. The **Atmospheric Correction** option in the **Scanner** > **Settings** panel remains **Off**. The PPM value of the scanner and in Perspective remain at zero.

- Different from zero, the **Atmospheric Corrections Updated** dialog opens:

Do one of the following:

- Apply the previously value (saved in Perspective) to the instrument*.

- Apply the current value of the instrument (to the instrument itself and to Perspective)*.

- Tap ⚏ to configure a new value. In the **Configure Atmospheric Corrections** dialog, define a new PPM value*.

○ Tap ✕ to disable the correction. The **Atmospheric Corrections** option in the **Scanner** > **Settings** pane remains **Off**. The PPM value of the scanner is reset to zero.

> **NOTE –** (*) The **Atmospheric Corrections** option in the **Scanner** > **Settings** pane will turn **On**.

On

The scanner has an atmospheric correction set which:

○ Has the same value as the value saved in Perspective, the atmospheric correction value will be applied to all scans to be captured. Tap ⛅ to open the **Scanner** panel and tap ⛅ again to edit the correction value.

Configure Atmospheric Corrections

Enter the atmospheric pressure and temperature to calculate the correct Parts Per Million (PPM) value.

Pressure (500.00 - 3500.00)

| --- | mbar |

Temperature (-20 - 50)

| --- | °C |

Parts Per Million (-809 - 151)

| 55 | ⊗ |

Current Instrument Value = 55 PPM

✕ Cancel   ✓ Save

Define an atmospheric correction value as described above and optionally, use ⊗ to clear all the values. "---" will be displayed in all fields

> **NOTE –** If you set zero to the atmospheric correction value, the PPM 🌥 icon is displayed.

○ Is different from the value saved in Perspective, the **Atmospheric Corrections Updated** dialog opens:
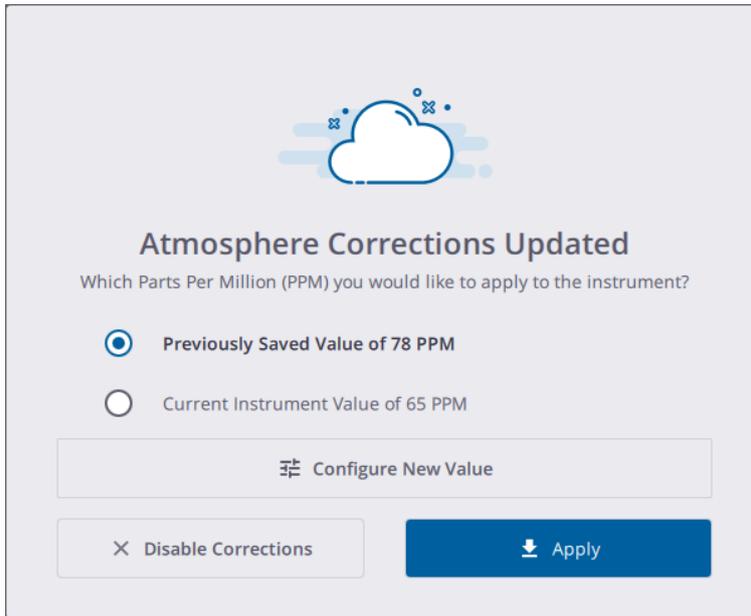
Do one of the following:

- Choose to apply the previous value (saved in Perspective) or the current value of the instrument.

- Configure a new value. Tap ⛭ to open the **Configure Atmospheric Corrections** dialog and define a new PPM value as described above.

- Disable the correction. Tap ✕ to turn the **Atmospheric Corrections** option **Off** in the **Scanner** > **Settings** pane and to reset the PPM value of the scanner and of Perspective to zero.

CAUTION – When you turn **Off** the scanner, the PPM value of the scanner is reset to zero. The next time you reconnect to the scanner; and you choose to apply the scanner's PPM value, Perspective will display the PPM icon in **GRAY** 🎛

TIP – When you are using the scan **Push** button workflow straight after a restart of the scanner, the scanner applies 0 ppm. Please connect with Perspective in order to reset the atmospheric corrections before continuing.

NOTE – When a scan is in progress, the atmospheric correction value cannot be changed. The **Atmospheric Correction** icon and the related option in ⚙ **Settings** > Scanner are grayed-out.

Once finished, for a:

- Full dome scan, the icon and the option become enabled again. You can change the value, disable, enable the option. Changing the PPM value will disable the **Area Scan** and **Laser Pointer** features.

- Area scan, the icon and the option remain grayed-out. The value still remains unchangeable, and you cannot disable or enable the option either.

CAUTION – When you uninstall and reinstall (or upgrade) Perspective, the last saved PPM value is kept.

Level a Scanner

Before starting the first scan on the project, it is recommended that you level the scanner. It is not necessary to level every scan but it is a good practice to level the first scan to use as the reference scan for registration.

X7 & **X9**

The **LED Leveling Guide Color** option (see ⚙ **Settings** > Scanner) helps you level your scanner. It indicates which leg on the tripod needs to be adjusted.
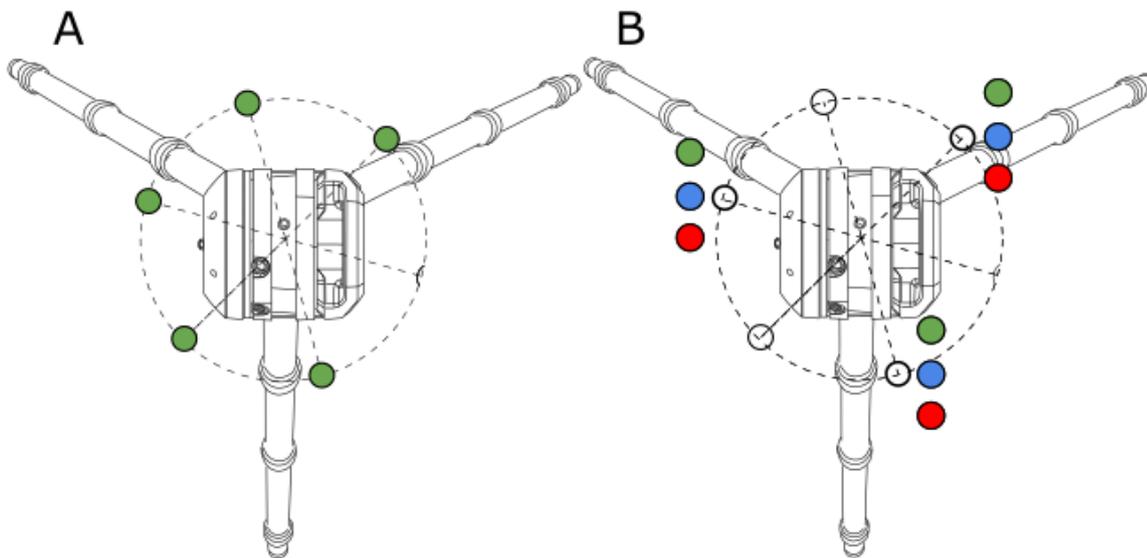
When the scanner is:

- **A - LEVELED**: It is within a range of +10° and -10° from either side of its vertical axis. All the five LEDs on its base are solid green.

- **B - NOT LEVELED**: It is out of the +/- 10° range. A leveling guide LED (three at all, positions illustrated above) is:

  Green Flashing means that the leg near the LED does not need adjusting.

  Blue Flashing means that the leg near the LED is too low.

  Red Flashing means that the leg near the LED is too high.

Adjust the length of the leg(s) until all the five LEDs turn solid green.

> **NOTE –** The five LEDs will not light if the **LED Color** option is off.

X12

> **CAUTION –** Use only the onboard electronic bubble to level the scanner. The tribrach level bubble can differ from the electronic level display and should only be used for coarse leveling > ±0.5°.

Check the level bubble in the status bar on the touch screen display of the scanner to see if the level bubble is green or red.

If the level bubble is:

- ⊚, the scanner is leveled.
- ◉, the scanner is not leveled.
- ◎, the scanner is out of range.

> **NOTE –** To level the scanner, first make sure the **Compensator** is turned on. See ⚙ **Settings** > **Scanner** > **Compensator**.

Tap ◎ in the status bar to open the full screen electronic bubble. The electronic bubble will display:

- **Red without the Level Bubble**: The scanner is out of range. Manually level the tripod until the white level bubble appears for finer adjustment with the electronic bubble.

- **Red with the Level Bubble Outside of the Red Target Area**: The scanner is not leveled.
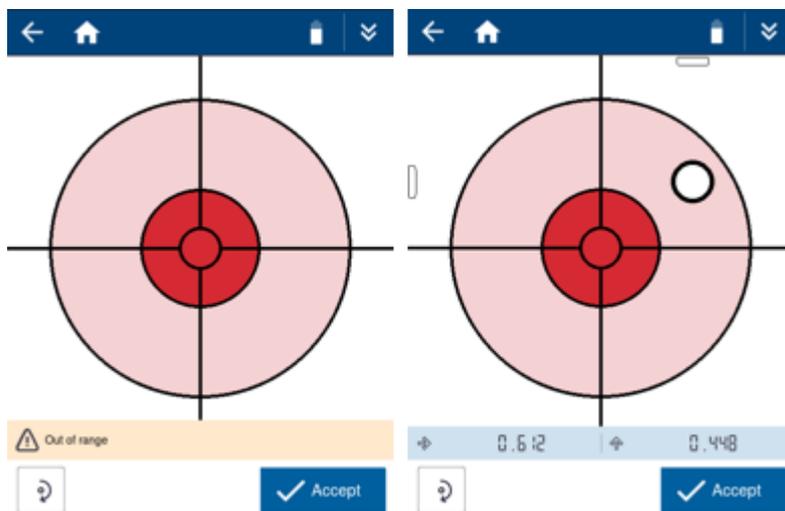
- **Green with the Level Bubble Inside the Green Target Area**: The scanner is leveled within the compensation range of ±0.5°. The target will turn green once the bubble touches the outer edge of the target but it is important to center the bubble on the green target to ensure the scanner remains within the

compensation range throughout the full scan.
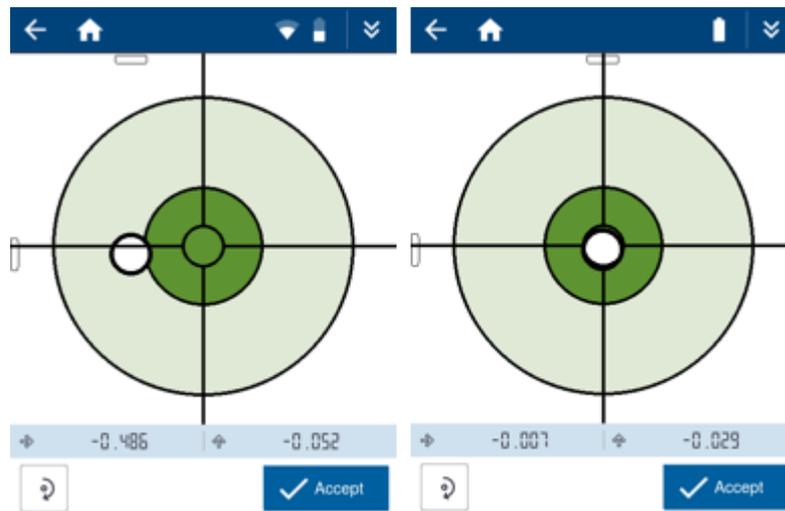
Tap ✓ when you are satisfied.

> **NOTE –** For more information, refer to the Trimble X12 scanner user guide.

Define Advanced Wi-Fi Settings

NOTE – The **Wi-Fi Advanced Settings** panel is enabled only if you are connected to a scanner.

The scanner has the wireless 802.11n technology. It supports the **2.4 GHz** and **5 GHz** frequency bands. For each new-shipped scanner, the default factory values for the Wi-Fi settings are:

- **Auto** for the **Frequency Band**.
- **Auto** for the **Channel**.
- **Empty** for the **Region Code**.

At the first connection with a new scanner (or if connected to a different **Region Code** scanner), the software updates the scanner with the controller's **Region Code**, and keeps the **Frequency Band** and the **Channel** unchanged (**Auto**).

During the update process, the controller disconnects and reconnects to the scanner automatically. Based on the controller's **Region Code**, the scanner scans the Wi-Fi environment to select the good frequency and channel to use.

Wi-Fi Advanced Settings

Changing these settings will reset the connection

Current Configuration

2.4 GHz | Channel 6 | **Region DE**

Network Password	✏ Change
Frequency Range	Auto ▼
Channels	Auto

☐ Include Indoor Channels

Cancel   Apply

Besides the **Auto** mode, you can switch between **5 GHz** and **2.4 GHz**. The **5 GHz** frequency provides a faster data exchange rate at a shorter distance while the **2.4 GHz** frequency offers coverage for further distances, but may perform at a slower speed in the data exchange. Both frequencies can be used with a multitude of channels including indoor use channels.

X7 - When setting the **5 GHz** frequency band in **Japan**, on every scanner's new start the **Auto** channel with **2.4 GHz** is available only. You would apply the **5 GHz** manually again. The **5 GHz** frequency band can be used with a multitude of channels including channels that have a **DFS** waiting time of 1 minute and/or indoor use channels.

Wi-Fi Advanced Settings
Changing these settings will reset the connection

Current Configuration
2.4 GHz | Channel 11 | **Region JP**

Network Password	✏ Change
Frequency Range	Auto ▾
Channels	Auto

☐ Include Indoor Channels
☑ Include DFS 60 Channels
ⓘ An additional 60 secondes is required at start up to secure the channel

Cancel   Apply

The **DFS** (Dynamic Frequency Selection) utilizes under-serviced frequencies in the **5 GHz** frequency band to increase the number of available Wi-Fi channels.

To update the current Wi-Fi password, tap ✏ **Change** and set a new Wi-Fi password (see Set Wi-Fi password).

- **X7**

  TIP – To reset the Wi-Fi settings to the default values (2.4 GHz Auto mode), press the **On/Off** button located on the right side of the scanner for at least 20 seconds until you hear five consecutive beeps. This process is useful to clear the **Frequency Range**, the **Channel**, and the **Region Code**. This process also resets the Wi-Fi password to the default factory value.

  CAUTION – When you connect a tablet (Trimble Perspective) and an Android (or iOS) phone (Trimble Perspective Mobile) at the same time to a scanner, only the **Region Code** of the tablet is used to update the scanner.

- **X12**

> **TIP –** To reset the Wi-Fi settings and the Wi-Fi password to the defaults (**Frequency** to **2.4 GHz**, **Channel** to **5**, **Country** to **Germany (De)** and **Wi-Fi Password** to the factory default value), tap ⚙ **Settings** > 💾 **About** from the on-board application.

Tap **Apply**, the controller automatically disconnects and reconnects to the scanner.

> **NOTE –** Perspective does not allow you to change the Wi-Fi settings or the Wi-Fi password when a scan is in progress.

Define Scan Parameters

To access the parameters, tap the pull-down arrow above the **Start Scan** button.
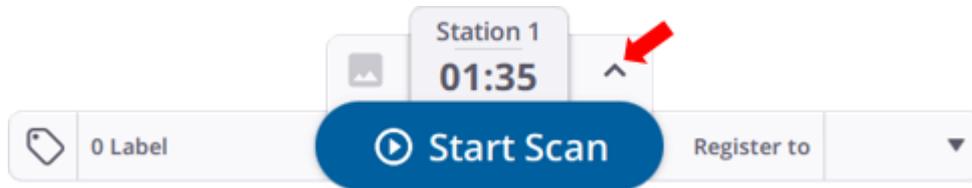
> **TIP –** To structure your project, assign labels to the data (see Capture Scans). This step is optional and labels can also be assigned to individual scans after they have been collected (see Add Labels).

X7

The **Scan Time & Images** panel pops up showing the scan parameters:
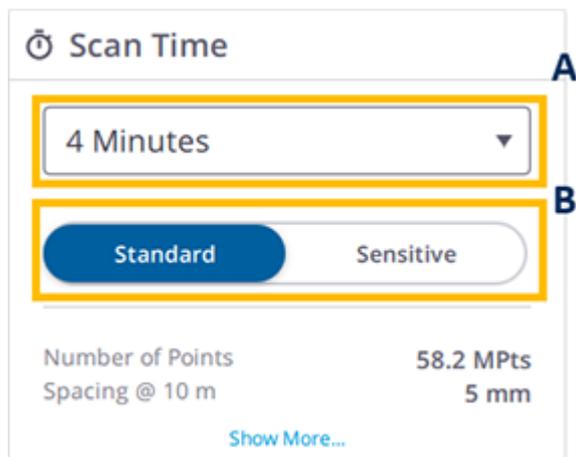
- **A - SCAN DURATION**. It affects the density (called **Spacing** referring to the distance between two consecutive points) and the number of points.

- **B - SCAN MODE**. It sets the speed and quality of a scan.

  The **Indoor** mode is for the fastest data acquisition. Turn on the option in ⚙ **Settings** > Scanner to enable the mode.

  The **Standard** mode is for high speed (500 kHz), shorter-range data acquisition.

  The **Sensitive** mode has lower speed (166 kHz) for longer range and higher sensitivity to capture dark surfaces.

The table below shows the **Scan Mode(s)**, the **Spacing** at different distances and the number of points available for each **Scan Duration**.

> **NOTE –** **Scan Duration** includes **Auto-Calibrations**.

Scan Duration	Scan Mode	Spacing (mm) @ 10m	Spacing (mm) @ 35m	Spacing (mm) @ 50m	Spacing (mm) @ 80m	Number of Points (Mpts)
Indoor	Indoor	11	NA	NA	NA	12
2 Minutes	Standard	11	40	57	91	12
4 Minutes	Standard	5	18	26	41	58
7 Minutes	Standard	4	12	18	28	125
4 Minutes	Sensitive	9	33	47	75	17
7 Minutes	Sensitive	6	21	30	48	42
15 Minutes	Sensitive	4	13	19	30	109

First, select a **Scan Duration**. The **Scan Mode** is set automatically. If not, choose between the two modes.

> **NOTE –** After choosing a **Scan Duration** and a **Scan Mode**, the duration (in minutes and seconds) is updated.

Activate the **Self-Leveling** feature before acquiring scans (see Self-Leveling).

> **CAUTION –** Scans taken with the **Self-Leveling** feature off will be labeled as **Leveling Off** (even if the scanner is leveled) and will not be automatically registered.

X9

<u>CORE (500 kHz - 80 m):</u>

Scan Duration defines the density and the number of points. The following table shows the durations, the point spacing at different distances and the maximum number of points you can expect from each scan.

Scan Duration[1]	Duration (min:sec)	Spacing (mm) @ 10 m	Spacing (mm) @ 35 m	Spacing (mm) @ 50 m	Spacing (mm) @ 80 m	Number of Points (Mpts)
Indoor	00:50	15	NA	NA	NA	6.8
2 Minutes	02:03	8	26	38	60	27.2
4 Minutes	03:33	5	18	25	40	61.2
6 Minutes	05:36	4	13	19	30	108.8

<u>PREMIUM - (1000 kHz - 150 m):</u>
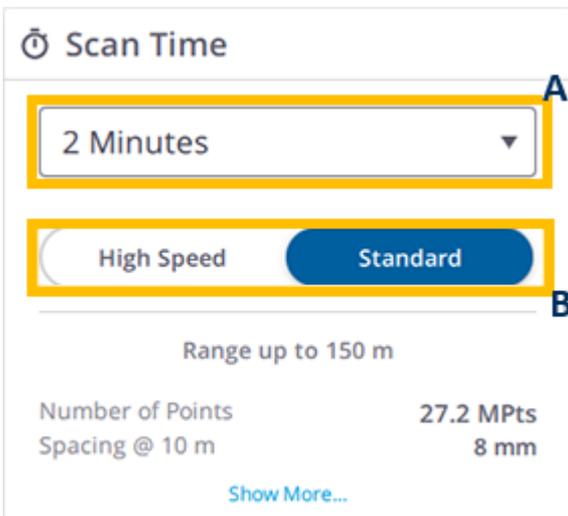
- **A - Scan Duration**: It defines the density and the number of points for the three scan modes. You will first select a preset duration and the scan mode is either set automatically or you can choose between the three modes.

- **B - Scan Mode:** It sets the speed and density of a scan.

  The **Indoor** mode reduces the calibration time and limits the range to **30 meters** for indoor applications.

  The **Standard** mode is (500 kHz) for full range data acquisition up to **80 meters** and **150 meters**.

  The **High Speed** mode is (1000 kHz) for high-speed data acquisition up to **120 meters**.

The following table shows the durations available for the scan modes, the point spacing at different distances and the maximum number of points you can expect from each scan.

Scan Duration[1]	Scan Mode	Duration (min:sec)	Spacing (mm) @ 10 m	Spacing (mm) @ 35 m	Spacing (mm) @ 50 m	Spacing (mm) @ 80 m	Number of Points (Mpts)
Indoor	Indoor	00:50	15	NA	NA	NA	6.8
2 Minutes	Standard	02:03	8	26	38	60	27.2
4 Minutes	Standard	03:33	5	18	25	40	61.2
6 Minutes	Standard	05:36	4	13	19	30	108.8
2 Minutes	High Speed	01:27	8	26	38	60	27.2
4 Minutes	High Speed	03:15	4	13	19	30	108.8
6 Minutes	High Speed	06:08	3	9	14	20	244.8

[1]Scan Duration includes self-leveling time within ± 10° and can increase up to 30 seconds for full calibrations after start-up or idle time until thermal stabilization.

[2]Spacing refers to the distance between two consecutive points.

X12

The **Scan Mode & Images** panels pop up showing the parameters:

Set the scan parameters by using the sliders to set the **Resolution** and **Quality** settings for the current station. The following scan properties are updated at the bottom of the screen as the settings are adjusted so you will know the time required and the level of data that will be captured.

- Scan Time = min:sec

- Acquisition Rate = MPts/s

- Point Spacing = mm @ 10m or in @ 33 ft

The table and tips below will help you select the best scan resolution for your project.

Resolution	Ideal Distance (m)	Spacing mm @ 10 m	Spacing mm @ 35 m	Spacing mm @ 50 m	Max. Number of Points (MPts)	Max. File Size (MB)
Preview	--	50.3	176.0	251.3	0.69	5.4
Low	> 1	25.1	88.0	125.6	2.78	21.4
Middle	> 2	12.6	44.0	62.8	11.12	85.3
High	> 5	6.3	22.0	31.4	44.47	341.2
High x2	> 20	3.1	11.0	15.7	177.90	1 3000
High x4	> 20	1.6	5.5	7.8	711.59	5 3000
High x10	> 100	0.6	2.2	3.1	4446.48	33 300

> **TIP –**
>
> - Scanning at short range can result in overlapping scan points and lower resolution scans are often sufficient. Higher-resolution scans are most suitable for scanning long-range objects.
>
> - A greater number of lower resolution scans will often give you better overall coverage than a fewer number of high resolution scans because you will capture data from more viewpoints and have more overlap for registration.
>
> - The **Preview** resolution is not recommended for scans where you will want to take exact measurements due to the low resolution and is only intended for the location of high-resolution area scans.
>
> - The **High** resolution is optimally suited for most applications.
>
> - The **High x2** and **High x4** resolutions are recommended to capture more distant objects or to capture fine details on complex objects, but the scan size will be greater and the scan time will be longer. Consider area scans to save time in the field.
>
> - The **High x10** resolution should only be chosen for small area scans or very long-range objects. A complete scan with this resolution requires significantly more time, an enormous amount of storage capacity (> 33 GB) likely exceeding a computer's memory.

The table and tips below will help you select the right quality setting while taking into account the time required to capture a specific scan.

	Quality / Scan Time (min:sec)			
Resolution	Speed	Balanced	Good	Best
Preview	--	00:23	---	---
Low	00:23	00:46	01:34	
Middle	00:46	01:34	03:07	06:14
High	01:33	03:07	06:14	12:29
High x2	03:06	06:14	12:28	24:59
High x4	06:13	12:28	24:57	48:59
High x10	--	38:58	78:00	156:18

TIP –

- The higher the quality level, the longer it takes to complete a scan, but the range noise is reduced. With each quality level scan times will be doubled and the range noise will be reduced by a factor of 1.4.

- Consider using the higher quality settings in area scans and for special applications where premium data quality is desired.

- The **Speed** and **Balanced** quality setting is suitable for most applications because the range noise is still low.

- The **Good** and **Best** quality setting will help reduce noise in more difficult outdoor environments.

- Range noise reduction may not be as noticeable on short-range scans.

- Depending on the roughness of the surface, the reduction in range noise may be smaller, particularly when scanning on bright surfaces at short distances.

Define Image Parameters

Optionally, tap the pull-down arrow above the **Start Scan** button.

X7 & **X9**

The **Scan Time & Images** panel pops up showing the image parameters. Set the **Images** mode on to capture the images.

> NOTE – The **Images** icon when enabled means that the **Images** mode is on.

Set the **HDR** mode on to capture images with more color and detail in bright and dark areas. The **HDR** mode increases the acquisition duration. See HDR.

> NOTE – The **HDR** icon when enabled means that the **Images** and **HDR** modes are on.

After choosing a **Scan Duration**, and a **Scan Mode**, and setting the **Images** and **HDR** modes to on, the exact duration (in minutes and seconds) is updated.

X7

Scan Duration	Scan Mode	Images Off (min:sec)	15 Images (min:sec)	15 Images + HDR (min:sec)	30 Images (min:sec)	30 Images + HDR (min:sec)
Indoor	Indoor	01:10	02:10	04:10	03:10	07:10
2 Minutes	Standard	01:35	02:35	04:35	03:35	07:35
4 Minutes	Standard	03:43	04:43	06:43	05:43	09:43
7 Minutes	Standard	06:39	07:39	09:39	08:39	12:39
4 Minutes	Sensitive	03.33	04:33	06:33	05:33	09:33
7 Minutes	Sensitive	06:54	07:54	09:54	08:54	12:54
15 Minutes	Sensitive	15:40	16:40	18:40	17:40	21:40

X9

CORE (500 kHz- 80 m):

Scan Duration	Images Off (min:sec)	15 Images (min:sec)	15 Images + HDR (min:sec)	30 Images (min:sec)	30 Images + HDR (min:sec)
Indoor	00:50	01:50	03:50	02:50	06:50
2 Minutes	02:03	03:03	05:03	04:03	08:03
4 Minutes	03:33	04:33	06:33	05:33	09:33
6 Minutes	05:36	06:36	08:36	07:36	11:36

PREMIUM (1000 kHz- 150 m):

Scan Duration	Scan Mode	Images Off (min:sec)	15 Images (min:sec)	15 Images + HDR (min:sec)	30 Images (min:sec)	30 Images + HDR (min:sec)
Indoor	Indoor	00:50	01:50	03:50	02:50	06:50
2 Minutes	Standard	02:03	03:03	05:03	04:03	08:03
4 Minutes	Standard	03:33	04:33	06:33	05:33	09:33

Scan Duration	Scan Mode	Images Off (min:sec)	15 Images (min:sec)	15 Images + HDR (min:sec)	30 Images (min:sec)	30 Images + HDR (min:sec)
6 Minutes	Standard	05:36	06:36	08:36	07:36	11:36
2 Minutes	High Speed	01:27	02:27	04:27	03:27	07:27
4 Minutes	High Speed	03:15	04:15	06:15	05:15	09:15
6 Minutes	High Speed	06:08	07:08	09:08	08:08	12:08

Keep the **White Balance** correction mode to **Auto** or select a preset for either indoor or outdoor shootings like **Cloudy**, **Sunny**, **Fluorescent** and **Incandescent**. See White Balance.

- ⒶW **Auto** is recommended when the lighting conditions are inconsistent.
- ☀ **Sunny** is for outdoors in bright sunlight.
- ☁ **Cloudy** is for outdoors on overcast days.
- **Fluorescent** is for indoors when bright fluorescent lighting is present.
- **Incandescent** is for indoors when more natural incandescent lighting is present.

> **TIP –** You can change the **Images** mode, the **HDR** mode, and the **White Balance** correction preset during the **Initialization** step (see Initialization), before the images are captured and during the scan.

> **NOTE –** In the ⚙**Settings** > Images panel, choose the **Number of Images** to capture. Optionally, automatically create a **Preview Panorama** from the images following their acquisition.

X12

The **Scan Mode** and **Images** panels pop up showing the parameters.
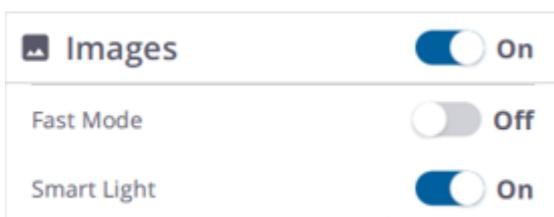
Images: Set this mode on to capture the images. After choosing a **Resolution**, and a **Quality**, the exact duration (in minutes and seconds) is updated.

> **NOTE –** The scanner always takes HDR images and the HDR algorithm determines the number of images required for the HDR exposure based on the current lighting conditions.

⊒🕗 **Fast Mode**:

- Activate this mode for most lighting conditions to save time. It will capture 2-5 images from each position depending on the lighting conditions. The image acquisition is approximately two minutes.

- Deactivate this mode in extremely bright or dark ambient conditions. It will capture 3-7 images from each position, increasing the image acquisition time to approximately 2 minutes 30 seconds. In extremely bright or dark ambient conditions, you may consider deactivating the **Fast Mode** if getting the highest quality panorama is more important than saving time.

💡 **Smart Light**: This mode should be activated to improve the color quality in poor lighting conditions and completely dark environments. It can also be activated in all lighting conditions for general overall improvements and to speed up the image acquisition time.

Capture Scans

> **CAUTION –** You should always stay clear of the scanner during the scanning process to avoid obstruction of data acquisition.

Either you can capture a 360° scan (**Full Dome**) or a scan on a specific area of interest (an **Area**). The first station of a new project (or the new station of an existing project) is always a full dome scan.

Capture the First Scan

The name of the first station displays above the **Start Scan** button.
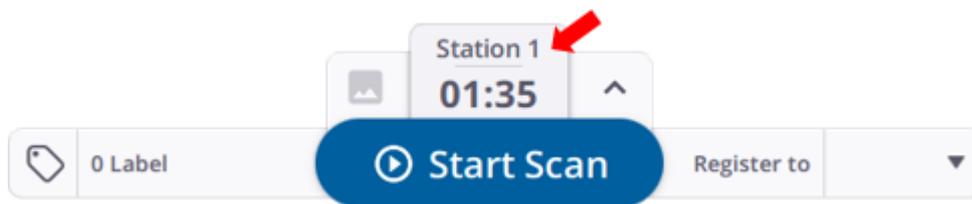
X7 & **X9**

Tap the **Start Scan** button. If no parameters have been previously defined, the default values are used (Full Dome scan, 2 minutes Scan Duration, Standard Scan Mode, and Images mode off).

A scan acquisition is a sequence of the following steps:

- **INITIALIZATION**: This initial step consists in executing a **Tilt** measurement (see Self-Leveling) and / or an Auto-Angular Calibration). The scanner starts collecting data once this step is done.

  To interrupt the step, tap **Stop**.

  > **NOTE –** An **Auto-Angular Calibration** is run before each scan until the temperature in the scanner becomes stable.

- **DATA COLLECTION**: The scanner rotates clockwise around its axis to capture data. Once done, the scanner turns back counterclockwise to its initial position.

  To pause and resume a scan in progress, tap **Pause** and **Resume**.

  To completely interrupt a scan in progress, tap **Stop** and **Stop**.

> **NOTE –**
>
> - The scanner executes an **Auto-Distance Calibration** process before each scan.
> - The software performs a **Tilt** measurement at the end of a scan and compares the results with the first **Tilt** measurement. See Invalid Station.

- **DATA DOWNLOAD**: Once the scan has ended, the captured data is saved on the memory card as a TZF format file under the ScanData folder, and downloaded to the application database.
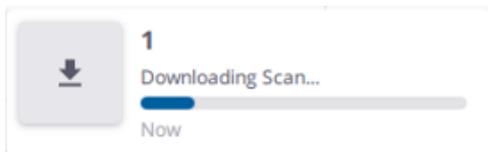
  Once the download step is completed, the captured data displays as a point cloud in the **Map View** (see **Visualize the Scan Data** > Map View) and as a station in the **Stations List** panel (see Manage Stations), and the next scan name displays above the **Start Scan** button.

- **AUTO-ORIENTATION**: This step consists in finding the correct orientation of the captured data. It is always applied to the first captured scan.

  To interrupt the step, tap ✕ from the **Stations List** panel.

  > **TIP –** If you are not satisfied with the orientation, change it by tapping the scan marker, ⟳ and use the manipulator to orient the scan along the X and Y axis.

- **NEXT CAPTURE STEP**: This step depends on the **Images** mode (see Define Image Parameters):

  On - The scanner will capture the images immediately after. Wait until the end of the images acquisition (see Capture Images) to capture the next step (Capture the Next Scan).

  Off - The scanner will not capture the images. After the **Data Download** step, capture the next (see Capture the Next Scan).

> **TIP –** Press and release the **On/Off** button (called scan **Push** button) on the scanner less than 1 second to capture a full dome scan without using a controller. The captured data is stored on the SD card and downloaded to the controller once the scanner is connected (see Synchronize Data) or plug the SD card to the controller and use the **Import** feature (see Import a Project (or a Scan)).

> **NOTE –** The settings for the scanner's scan **Push** button are the last used ones or the default ones (if using the scanner for the first time). Any change in the settings in the application is immediately taken into account by the scanner for the next scan.

> **NOTE –** The multi-color LEDs on the scanner blink blue during the whole scanning acquisition step.

X12

A scan acquisition is a sequence of the following steps:

- **INITIALIZATION**: The scanner rotates clockwise to position itself to the acquisition position.

  To interrupt the step, tap **Stop**.

- **DATA COLLECTION**: The scanner rotates clockwise around its axis to capture data.

  To pause and resume a scan in progress, tap **Pause** and **Resume**.

  To completely interrupt a scan in progress, tap **Stop** and **Stop**.

- **DATA DOWNLOAD**: Once the scan has ended, the captured data is saved to the internal memory of the scanner as a TOS format file, and downloaded to the application database.

- **DATA PROCESSING**: The TOS format file is converted to the TZF format.

- **AUTO-ORIENTATION**: This step consists in finding the correct orientation of the captured data. It is always applied to the first captured scan.

  To interrupt the step, tap ✕ from the **Stations List** panel.

  If you are not satisfied with the orientation, change it by tapping the scan marker, **Register** and use the manipulator to orient the scan along the X and Y axis.

Capture the Next Scan

Decide whether you want to capture a full dome scan or simply augment your survey data with a scan of a specific area of interest.
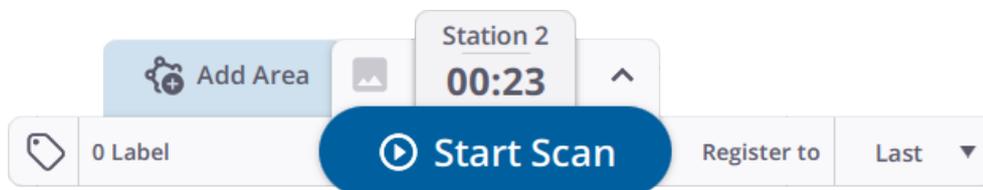
Full Dome

To ensure the best productivity and registration results, follow the rules below when moving the scanner:

- Keep the scanner attached to the tripod when moving from one position to the next.

- Maintain a good overlap with the previous scan or the scan you intend to register to.

  X7 & **X9**

- The scanner should not be tilted by more than 45° when moving to ensure best results with the IMU.

- Keep the distance between consecutive positions less than 10 meters. Depending on the environment you may need to have between 2 to 10 meters between scans.

X12

- Keep the distance between consecutive positions less than 10 meters when scanning outside with high resolution scans (> **Middle**).

- Keep the distance between consecutive positions less than 2 meters when scanning inside with low resolution scans (<**Middle**).

> **NOTE –** Having enough overlapping areas in scans and limiting the distance between positions help ensure good scan registration.

Tap **Start Scan**. By default, the current scan will register to the last scan (see Automatic Registration).

> **NOTE –** The settings for the (full dome) scans are persistent (the last used ones). Any change of the settings in Perspective is immediately taken into account by the scanner for the next scan.

Area

To enable the **Area Scan** feature, be sure to toggle on the **Self-Leveling** option in ⚙ **Settings** > Scanner and to have a leveled full dome scan. To ensure the best result, do not move the scanner from the first scanning position.

1. Tap 🔾 **Add Area**. The view switches to **Station View**, the **Area** panel opens and the first area scan can be configured (**Area 1**).

2. Choose an **Area Type**:

   - **Auto Selection** (type by default): Pick on an object in the scene to automatically frame the object with a rectangle.

   - **Rectangle** / **Horizontal Band** / **Vertical Band**: Tap two points.

3. Optionally:

   - **Auto Selection** / **Rectangle**: Drag and drop a corner to enlarge or reduce the rectangle.

   - **Horizontal Band** / **Vertical Band**: Drag and drop a point to enlarge or reduce the band.

> **NOTE –** After defining an area, an estimate of the duration (in minutes and seconds) and of the number of points are displayed.

> **CAUTION –** When an area scan is horizontally bigger than 180°, the scanner will scan it with one face (for an X12 only).

> **TIP –** Tap ↰, ↱ or ↻ to undo, redo or reset the area scan.

4. Optionally, define the parameters (see Define Scan Parameters or Define Image Parameters).

5. Tap **Start Queue**. The area scan automatically starts; it can be paused and resumed by tapping **Pause** and **Resume**.

6. Define additional area scans, if needed. For each new area scan, click **Add to Queue**.

   > **NOTE –** The area scans added to the queue will automatically start as soon as the first area scan is completed.

   > **NOTE –** The settings for the (area) scans are persistent (the last used ones). Any change of the settings in Perspective is immediately taken into account by the scanner for the next scan.

7. Tap ✕ to close the **Area** panel.

8. To stop an area scan (**Area N**), tap:

   ○ **Stop** next to the **Scan** button. Perspective stops the scanning queue. Tap **Start Queue** to start the queue from **Area N+1** and so on.

   ○ **Stop** from the **Queue** panel. Perspective stops the current area scan (**Area N**) and continues scanning the rest of area scan(s) (**Area N+1**, **Area N+2**, etc.) in the queue.

      > **TIP –** To display the **Queue** panel, tap 🔘 next to the **Stop** button while the scanner is scanner.

   > **TIP –** You can add new area scans to the queue by tapping **Create New** and **Add to Queue**.

   If you stop an area scan while the scanner is:

   ○ Scanning, Perspective keeps what has been scanned.

   ○ Initializing, Perspective keeps what has been scanned. In the **Station View**, the area scan remains displayed in dashes and orange. In the **Queue** panel, the area scan has its name displayed in orange. If required, tap **Retake** to rescan the area scan.
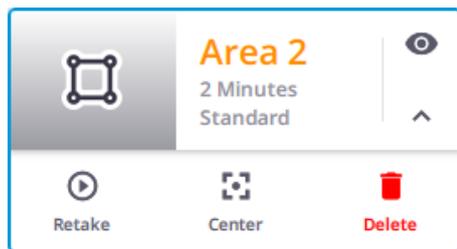
   > **NOTE –** Once an area scan has been stopped, toggling off the **Self-Leveling** option will close the **Area Scan** tool (if it is opened), and will clear the queue (if there was one). At the same time, a notification will pop up.

9. Optionally, tap the pull-down arrow to open the **Current Station** panel.
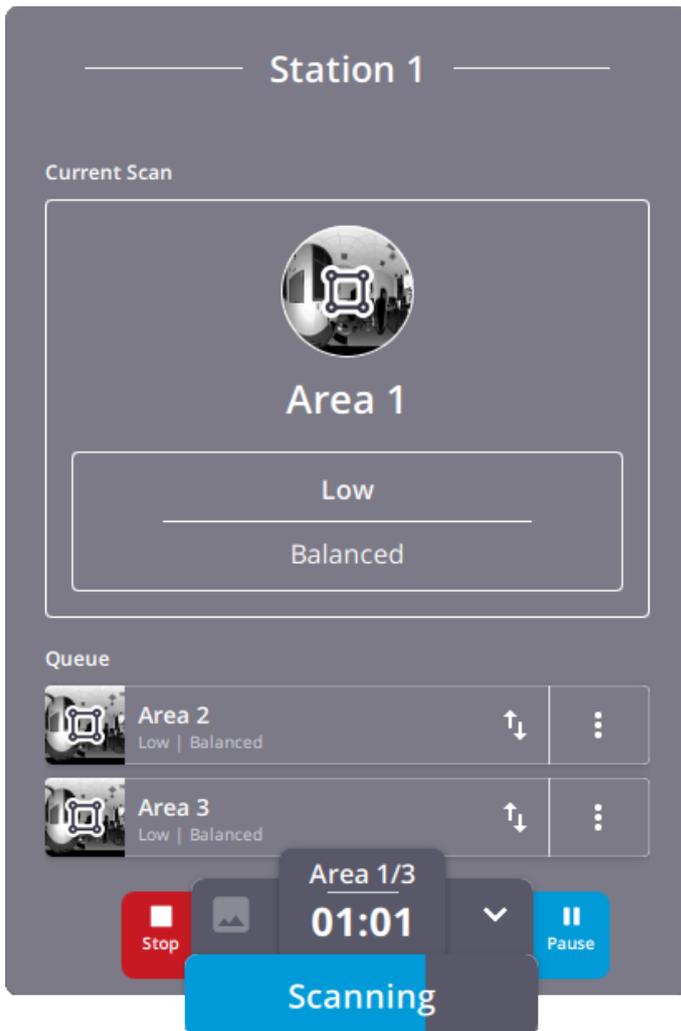
10. Tap.

    ○ ↑↓ and choose ↓ (or ↑) to change the order of an area scan.

    ○ ⋮ and choose ✎ (or 🗑) to edit (or delete) an area scan.

    > **NOTE –** Editing an area scan puts the area scan to the end of the queue.

11. If ✎ **Edit** has been chosen, the selected area scan panel opens. Change the shape of the area scan and/or update the parameters (see Define Scan Parameters or Define Image Parameters) and tap **Save**. The **Queue** panel opens.

    Tap:

- ○ ⊙ or ⦸ to hide or to show an area scan.

- ○ ⌄ and choose ⟐ or 🗑 to center an already captured area scan in the **Station View** or delete it.

- ○ ⌄ and choose ✎, or ⟐,or 🗑 to edit an area scan to be captured, or to center it in the **Station View**), or delete it.

- ○ **Create New** to create a new area scan.

Tap **Close**.

> **NOTE –** With the Indoor mode, the **Area Scan** feature is:
>
> - Enabled with an X9.
>
> - Disabled with an X7.

For each scan (full dome or area), a scan file is created and saved to:

X7 & **X9** - The memory card under the **ScanData** folder and the software database, as a file in TZF format.

X12 - The scanner internal memory as a file in TOS format, under the project folder and the software database, as a file in TZF format.

> **NOTE –** When a scan is in progress, the following cannot be changed:
>
> - **X9** - The atmospheric correction value (see Apply Atmospheric Corrections), the **Atmospheric Correction** icon and the related option in ⚙ **Settings** > Scanner are **On** and grayed-out.
>
> - The **Self-Leveling** status. The **Self-Leveling** option in ⚙ **Settings** > Scanner is **On** and grayed-out.
>
> Once the scan is finished, the options become enabled again. Turning the **Self-Leveling** option **Off** will disable the **Area Scan** feature.
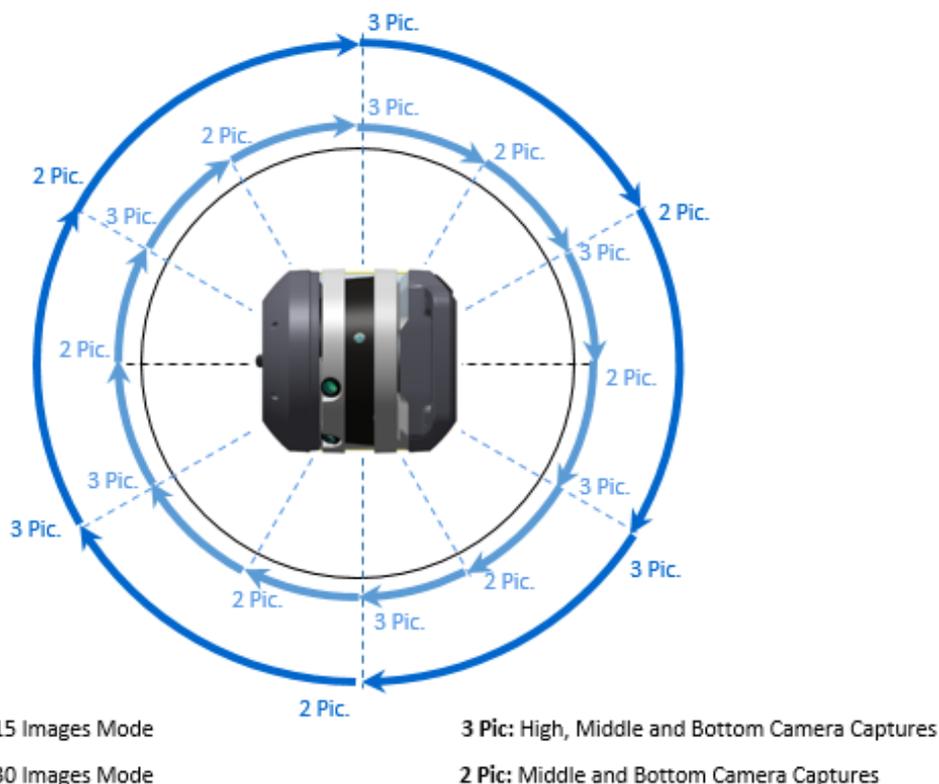
Capture Images

> **CAUTION –** Stay clear of the scanner during the image acquisition to avoid obstruction of the camera.

The captured images can be used to colorize scans, and optionally create panoramas.

X7 & **X9**

The scanner captures either fifteen images or thirty images for a full dome scan, depending on the number of images chosen in the ⚙ **Settings** > Images. Each image has a resolution of 3840 x 2748 pixels, and the exposure automatically adjusted.

15 Images Mode
30 Images Mode

3 Pic: High, Middle and Bottom Camera Captures
2 Pic: Middle and Bottom Camera Captures

An images acquisition follows the steps below:

- **DATA COLLECTION**: The scanner captures a set of images every 60° (or 30°).

  To pause and resume the step, tap **Pause** and **Resume**.

  To interrupt the step completely, tap **Stop** and **Stop**.

- **DATA DOWNLOAD**: Once the acquisition is complete, the images are saved to the memory card as a TCF format file under the ScanData folder and uploaded to the software database.
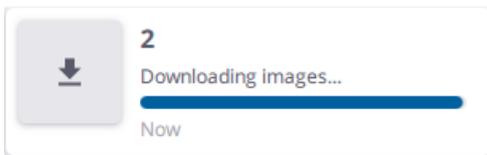
- **WHITE BALANCE AUTO-CORRECTION**: This step applies a **White Balance** correction in the **Auto** mode or with a chosen preset.

  Only the **Auto** mode can be interrupted. Tap ✕ from the **Stations List** panel.

- **PANORAMA CREATION**: The step is optional. It automatically creates a preview quality panorama based on the captured images. See Process Images. Once the creation is complete, a file in TPF format is created and saved, only to the software database.

  > **NOTE –** To interrupt the step, tap ✕ from the **Stations List** panel.

> **NOTE –** No TCF format file is created if you stop acquiring the images.

> **CAUTION –** Do not move the scanner to capture the next scan while it is capturing the images.

> **NOTE –** The multi-color LEDs on the scanner blink white during the whole image acquisition step.

X12

The scanner captures the images after completing the scan when the **Images** mode is turned On. The 80 MP camera produces impressive parallax free HDR images to complement your scan data.

For a full dome scan, the scanner takes forty-two images. Each image has a resolution of 1200 x 1600 pixels, and the exposure automatically adjusted.

An images acquisition follows the steps below:

- **INITIALIZATION**: The HDR algorithm determines the number of images required for the HDR exposure based on the current lighting.

  To pause and resume the step, tap **Pause** and **Resume**.

  To interrupt the step completely, tap **Stop** and **Stop**.

- **DATA COLLECTION**: The scanner captures a set of images at predefined angles.

  To pause and resume the step, tap **Pause** and **Resume**.

  To interrupt the step completely, tap **Stop** and **Stop**.

  > **NOTE –** If the **Smart Light** option has been enabled, the four LEDs around the build-in camera will flash while it captures the images.

- **DATA DOWNLOAD**: Once the acquisition is complete, the images are saved to the scanner internal memory as a TOI format file and uploaded to the software database.

- **PANORAMA CREATION**: The step is optional. It automatically creates a preview quality panorama based on the captured images. See Process Images. Once the creation is complete, a file in TPF format is created and saved, only to the software database.

> **NOTE –** To interrupt the step, tap ✕ from the **Stations List** panel.

> **NOTE –** For an area scan, the scanner will not take the same number of images as for a full dome scan, but only the images covering the defined area.

> **NOTE –** If the **Automatic Panorama Creation (Preview)** option has been checked, a preview quality panorama will be created for each scan with images (full dome or area) and if the full dome scan does not already have a high quality panorama.

Synchronize Data

Use ⟳ **Synchronize Scans** to synchronize the data between the scanner and the controller:

X7 & **X9** - In case the data has been collected using the scan **Push** button on the scanner (no controller). The scan **Push** button needs to be used in the following situations:

- When the Wi-Fi connection is lost.

- When the controller turns off because the battery level is low.

X12 - In case the data has been collected using the on-board application of the scanner:

> **NOTE –** For more information, refer to the Trimble X12 3D scanner user guide.

The prerequisite is to have the scanner connected first and to collect at least one scan. After reconnecting to the scanner, a message pops up and notifies the number of scans awaiting to synchronize.

Tap **Synchronize Scans** from the pop-up menu or ⟳ **Synchronize Scans** from the **Menu** bar. All the data (scans and images) are automatically downloaded and the scans are registered together.

Tap **Stop** to interrupt the synchronization.

Hybrid Workflow to Capture the Data

X7 & **X9** - Use your tablet (Trimble Perspective), your Android (or iOS) phone (Trimble Perspective Mobile), and the scan **Push** button on the scanner simultaneously or all together to capture the scan data.

- **CONNECTION:** Two different controllers are allowed to connect simultaneously to a scanner. See Connect to a Scanner.

- **PROJECT:**
  - A project created on your controller does not appear immediately on the other controller. Capture a scan with your tablet to see the created project on your Android (or iOS) phone.
  - Any scan done with the scan **Push** button on your scanner is immediately visible on your Android (or iOS) phone and can be synchronized with your tablet using the **Synchronize Scans** feature. See Synchronize Data.

- **SETTINGS:** Settings are synchronized between the controllers and the scanner. Any change on a controller is immediately taken into account by the scanner, and by the other controller. Parameters are:
  - Scan duration, Scan mode and Self-Leveling option. See Define Scan Parameters and ⚙ **Settings** > Scanner.
  - Image mode, HDR image mode and White balance mode. See Define Image Parameters.
  - Number of images. See ⚙ **Settings** > Images.
  - Scanner LED color and scanner LED Leveling Guide Color. See ⚙ **Settings** > Scanner.

7

Visualize, Register & Process

After acquiring the first scan, you can visualize the result in different viewers. Once two scans are captured, both are registered automatically together. Optionally, use the manual methods to refine the registration or to correct it if it fails.

Visualize the Scan Data

Each full dome scan defines a station, identified by a number, a marked position (triangle) and a color. All the captured scans display by default in the **Map View** (see Map View), but you can switch to the **Station View** display (see Station View) or to the **3D View** display (see 3D View).

Map View

The **Map View** enables you to visualize the scan data from the **Top View** (default view) and locked in 2D.
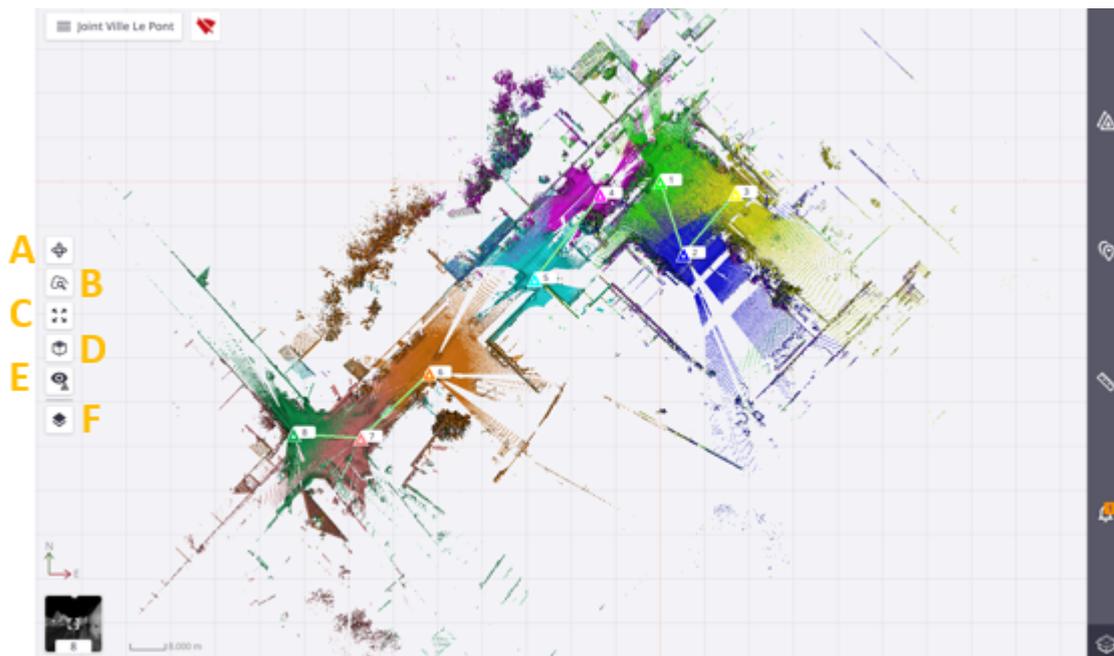
In this view, a station has a point cloud representation, with a **Marker** (station setup position) ◭ and **Label** (name) ◭1 . You can:

- Zoom in (or zoom out) all the displayed stations by stretching or pinching with two fingers.

- Pan by sliding with one finger.

- Zoom on a displayed station (or an empty area) by double tapping the station (or an empty area), with a factor of 1.75.

Or tap:

- **A - 3D View** to switch from the current view (2D locked view) to an unlocked view. See 3D View.

- **B - Magnify** to load more points inside a specific area. See Magnify.

- **C - Zoom Extends** to fit the scanning result(s) to the center of the view.

- **D - Views** to display the scanning results from **Top View**, **Front View** and **Right View**.

- **E - View Options** to expand the options. Tap one of the following:

  👁 to display all hidden stations.

  👁 to hide all displayed stations. Hiding all displayed stations hides all station positions, labels, registration links and all created annotation and precision points (see Points Tool).

  to display the most recent station(s). The number of most recent stations needs to be defined in the ⚙ **Settings** > General.

  > **TIP –** You can also tap a station position in the view and choose **Display Nearest** from the dropped-down list.

  ◎ to display the stations near the selected one. See Display Nearest. The number of nearest stations has to be defined in the ⚙ **Settings** > General.

- **F - Rendering Options** to access the options below. Tap:

  to hide all the points whose normal faces the screen (towards or backwards).

  to display points of the scan data without any visibility filtering.

  to change the display point size.

  ⚠ to hide all station markers, and labels (if displayed), and registration links (if existed).

  ⚠ to display all station markers, and labels (if displayed), and registration links (if existed).

  to hide all station labels. Display first all station positions.

  to display all station labels.

  to render the displayed points with one color per station.

  to render the displayed points with one color per scan.

  to render the displayed points with color-coded intensity.

  to render the displayed points using the gray scale defined by their intensity.

  to render the displayed points using their color (real color).

  to render based on the height information found in the points in the **Left Side** (or **Right Side**) view.

  to render the displayed points with one color per group (registration set).

  ⊞ to hide a **2D Grid** over the scan data.

  > **NOTE –** This **Cross** defines the origin of the project (0,0,0 as coordinates in the XYZ coordinate system). It is replaced by a **2D Grid** when hidden.

  to display a **2D Grid** over the scan data in **Top View**.

  to change the background color of the **Map View** to black.

  to change the background color of the **Map View** to white.

  📍 to display all annotations or precision points (**Pins** and **Labels**).

    to hide all annotations or precision points (**Pin** and **Label**).

    to display all annotations or precision points of a chosen station.

- To display the current station in the **Station View** (see Station View):
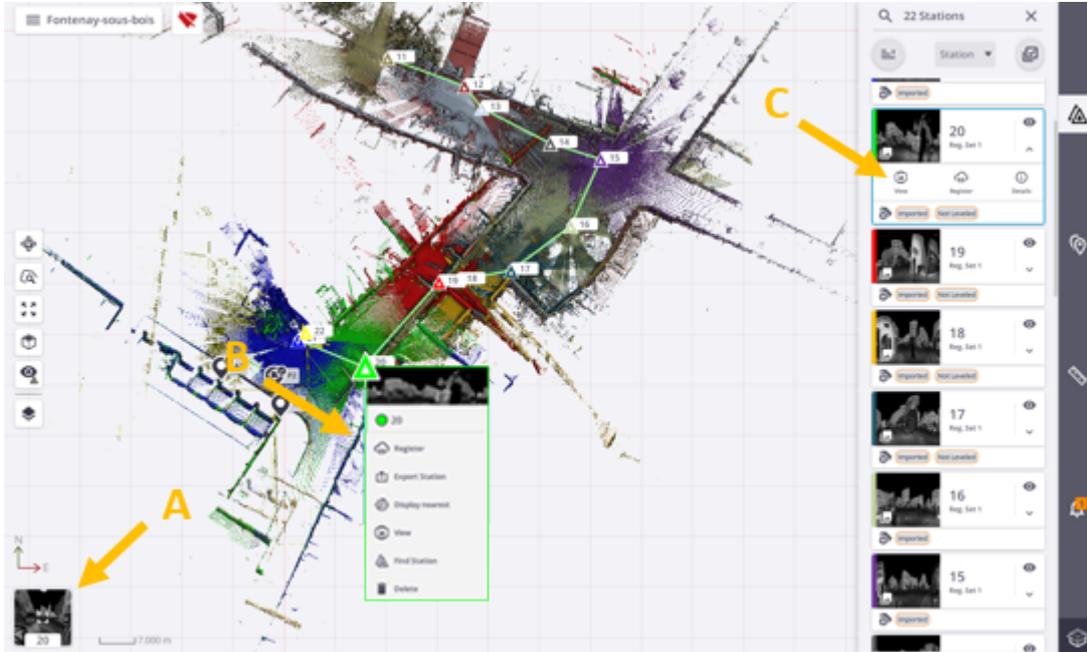
A - The thumbnail at the bottom left corner.

B - A station position to select **Station View** from the dropped-down list.

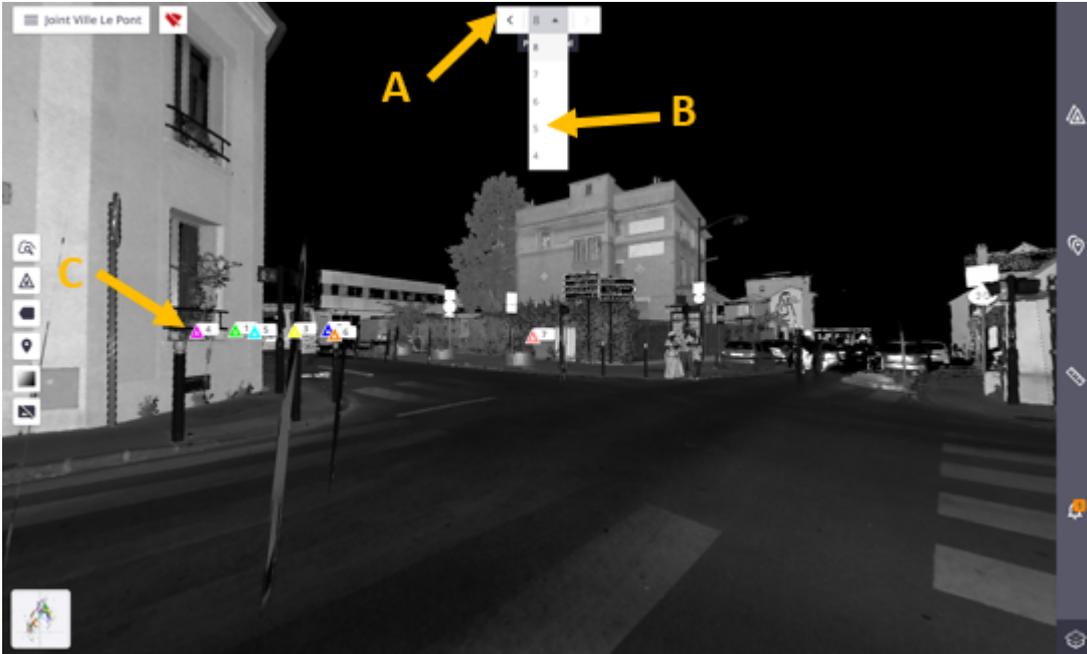C - **Station View** of a station card in the **Stations List** panel.

> **TIP –** In the **Station Details** panel, tap the thumbnail to switch from **Map View** to **Station View**.
>
>

Station View

The **Station View** enables a full-dome visualization of the whole scan data from the current station position. In this view, the scans from the current station are displayed.

To load a station, do one of the following:

- **A** - Tap ❯ (or ❮) to load the next station (or the previous station).

- **B** - Choose a station from the drop-down list.

- **C** - Tap a station marker.

- Tap ⚠ to open the **Stations List** panel, and choose a station card as illustrated below.
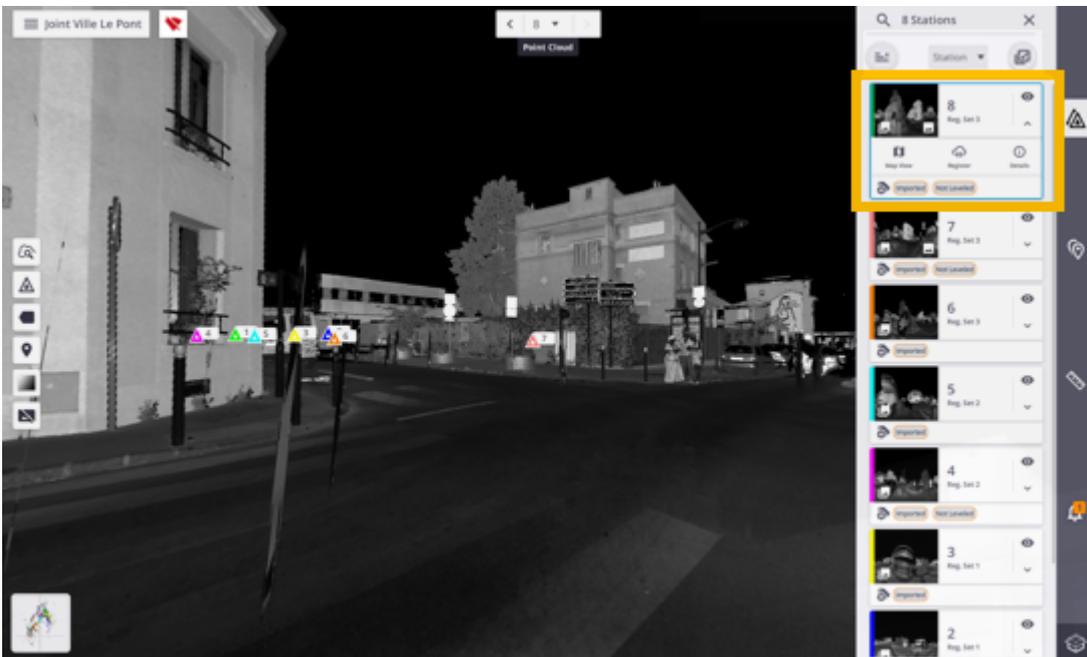
- Tap ⌄ to expand a station card, and ⓘ to view the details, and to display the **Areas** tab. Tap:

  👁 **Show Full Dome** to display the current full dome scan.

  🚫👁 **Hide Full Dome** to hide the current full dome scan.

 👁 to hide an area scan.

  🚫👁 to display an area scan.

In this view:

- Zoom in (or zoom out) from the station position by stretching or pinching with two fingers, or rotate around the station position by sliding with one finger.

- Use the following options:

  🔍 to load more points inside a specific area. See Magnify.

  ⚠ to hide all station markers, labels (if displayed), and registration links (if existed).

  ⚠ to display all station markers, labels (if displayed), and registration links (if existed).

  ⬟ to hide all station labels. Display first all station positions.

  ⬟ to display all station labels.

  📍 to display all annotations or precision points (**Pins** and **Labels**).

  📍 to hide all annotations or precision points (**Pins** and **Labels**).

  📍 to display all annotations or precision points of a chosen station.

  ⬛ to render the displayed points using the gray scale defined by their intensity.

  🟦 to render to the displayed points using their color.

 > **NOTE –** In case of an outdoor scan, the sky is rendered in black.

  🟥 to increase the color range in order to enhance the perception.

  🟥 to color in red the areas where there is no point.

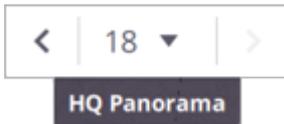- The current station is displayed as a 2D spherical luminance image.

  < | 16 ⌄ | >
  Point Cloud
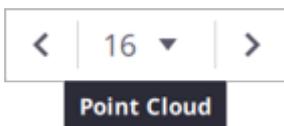
  If a panorama has been created, tap ⬛ to display in overlay:

  - The **Preview Panorama**, if a **Preview Panorama** has been created (see Preview Quality).

  < | 17 ⌄ | >
  Preview Panorama
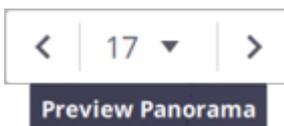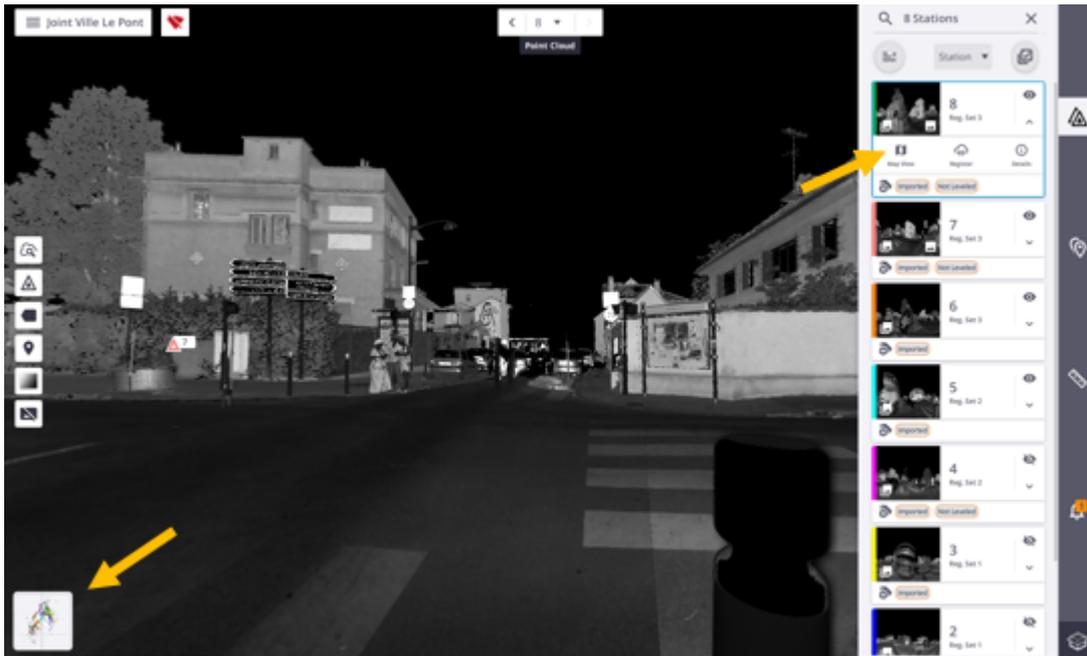
  - The **High Quality Panorama**, if a **High Quality Panorama** has been created (see High Quality).

Tap to display back the current station as a 2D spherical luminance image.

> **NOTE –** In the **Panorama** mode, you can view the other station positions and station labels only if these stations have a panorama created.

- Switch back to the **Map View** display by tapping:

- The thumbnail located at the bottom left corner.

- **Map View** from a station card in the **Stations List** panel.

- The thumbnail in the **Station Details** panel.
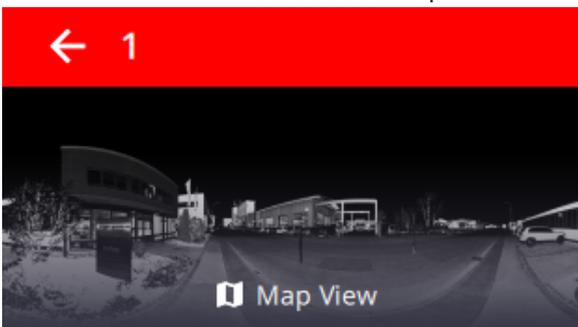
3D View

The **3D View** enables you to visualize the whole scan data in free navigation. In this view, each station has a point cloud representation, with a marker (triangle) and a name (Label).

In the view, you can:

- Zoom in (or zoom out) the whole scan data by stretching or pinching with two fingers.
- Rotate around a [[[Undefined variable Template.Action_Adjectif]]] position by sliding with one finger.
- Pan by sliding with two fingers.
- Display the scanning result(s) in the **Parallel** projection mode ⬡ or in the **Perspective** projection mode ⬡.
- Use the same options as in the **Map View**. See Map View.

Automatic Registration

The first station is not registered, and has the "Not Registered" label in the **Stations List** panel. It is automatically registered with the next captured station (see Automatic Registration).
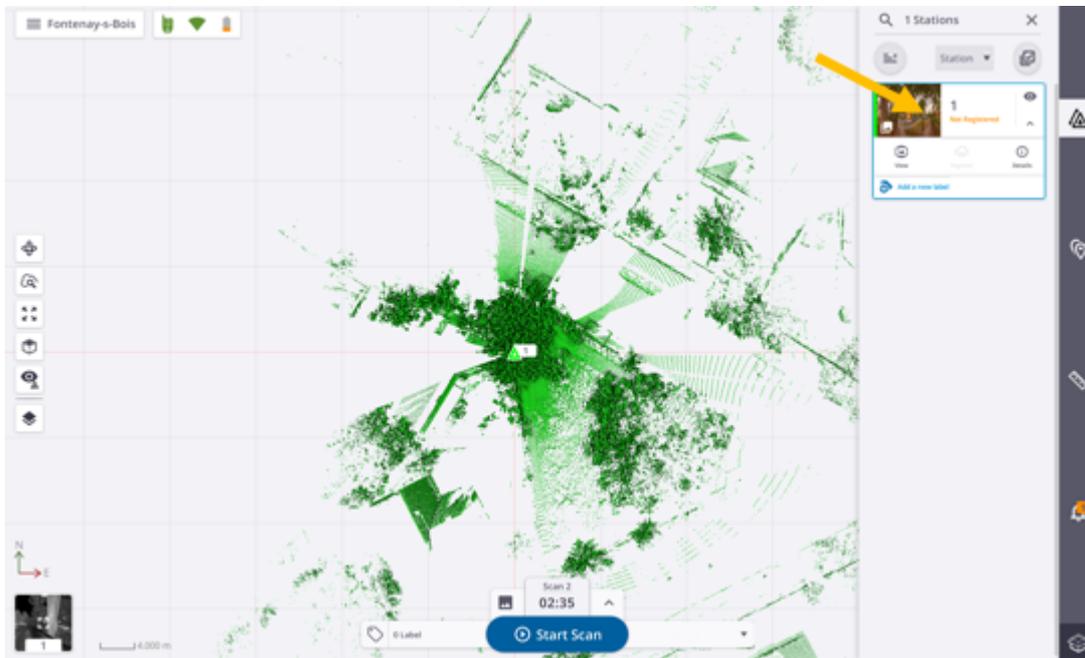
Once the registration done, a notification pops up and states the following status:

- **REGISTRATION COMPLETE**: The registration succeeds. A green notification pops up and a registration link is created between the two stations (see Edit Registration Links). Both stations are put into a common registration set, and the "Not Registered" label is removed from the first station.
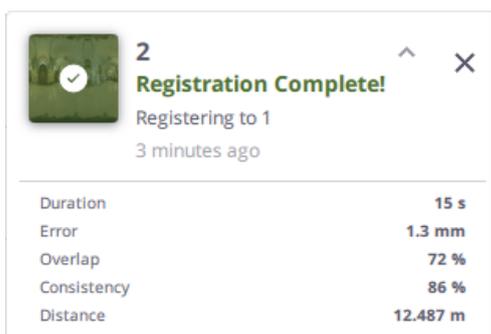
Each new station added to the project is automatically registered with the previous one, unless you especially choose a station from the **Register to** list. Stations that have been successfully registered per pair are put under the registration set (see Edit & Register Registration Sets).

- **AUTO-REGISTER TO 1 SKIPPED**: The registration is skipped and a green notification pops up. The two stations have been acquired from the exact same position.
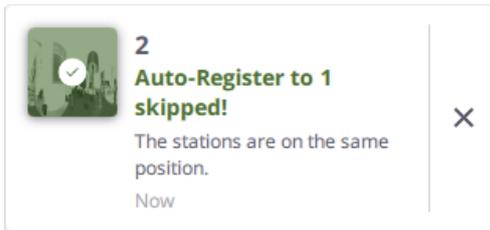
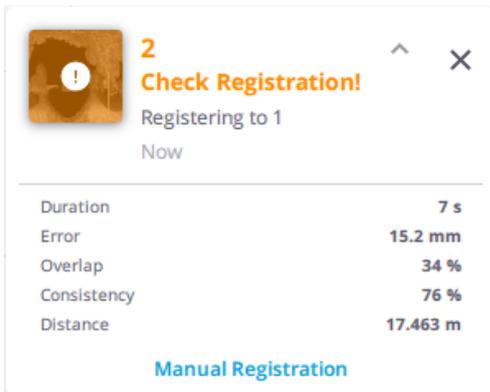- **CHECK REGISTRATION**: The registration needs to be checked. An orange notification pops up. It does not mean that the result is wrong. It indicates that the result may require a closer analysis.

  - If nothing is done, no registration link is created, and the second station starts a new registration set.

  - If the result looks good, tap **Manual Registration** and create a registration link between the two stations by tapping 🔗.

  - If the result looks bad, tap **Manual Registration** and register the two stations manually (see Manual Registration).

- **REGISTRATION FAILED**: The registration fails. A red notification pops up and no registration link is created between the two stations. Tap **Manual Registration** to register them manually (see Manual Registration).
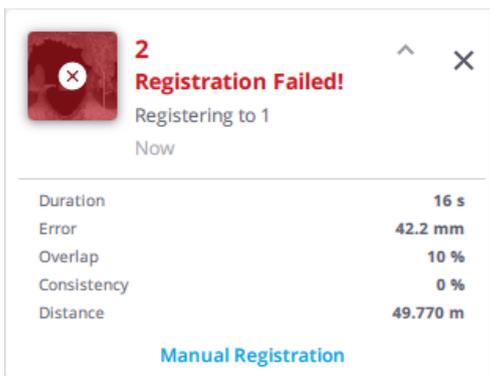
NOTE – All the acquired stations are stacked by order of acquisition in the **Stations List** panel (see Stations List Panel) and the **Register to** list next to the **Start Scan** button.

Manual Registration

The registration of two stations, whether it succeeded or failed, can be refined or re-registered manually. To open the
Manual Registration toolbar, tap:

- **A** - A registration link in the **Map View** and choose **Edit Link** (see [Edit Registration Links]).
- **B** - A station marker in the **Map View** and choose **Register**.
- **C** - A station card in the **Stations List** panel and select **Register**.
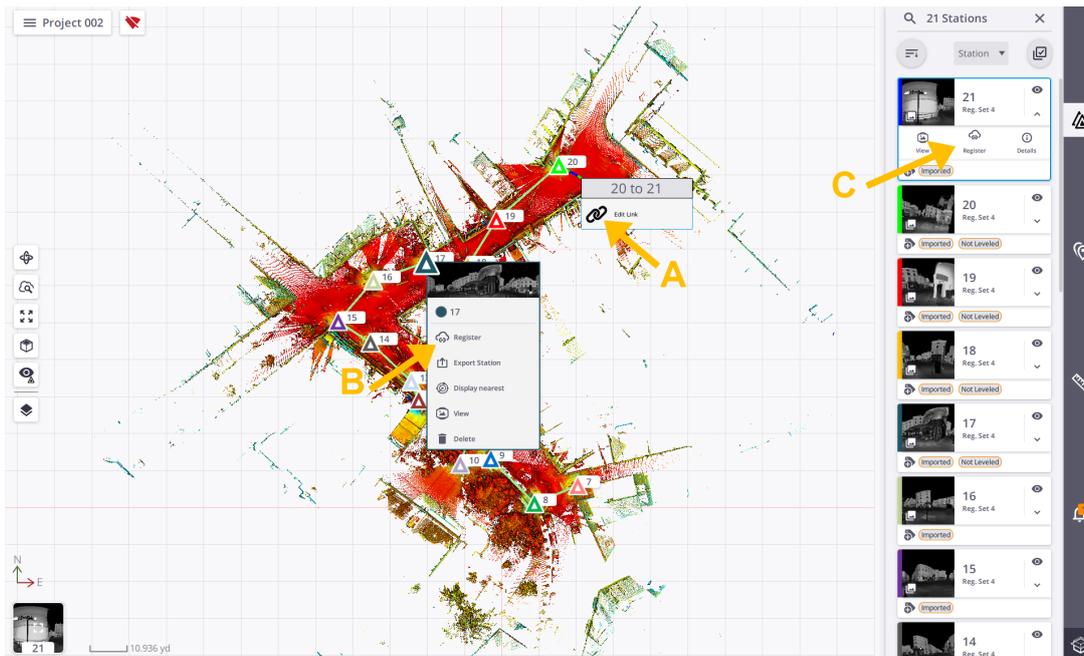
Move and Rotate a Station

In the **Manual Registration** toolbar, the selected station and the previous station display respectively in the **Moving
Stations** list (Blue list) and in the **Reference Stations** list (Gray list).
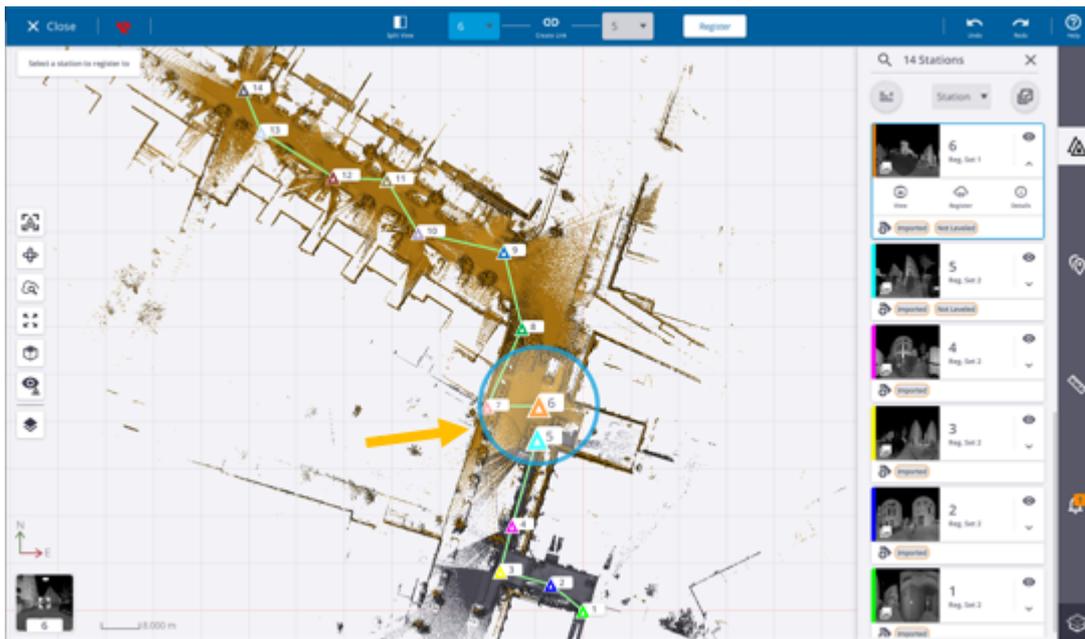
A ring manipulator appears over the moving station and the station positions of both are displayed bigger than the others. Here 5 and 4 are bigger than the rest.

To change either the moving station or the reference station, tap the pull-down arrow and choose a new one from the list.

- Optionally, use the ⬡ **Limit Box** feature to create a small section on the displayed point cloud for getting a clearer view of a specific area or for helping you to register the data. See Limit Box.

- In case of a huge amount of stations, use:

  ○ 🔲 to center the moving station in the middle of the **Map View**.

  ○ 👁 to hide all the stations except the two selected ones.

- If the moving station is far from the reference station, adjust its distance to the reference as follows:

  ○ Pick the moving station marker. Its color turns orange.
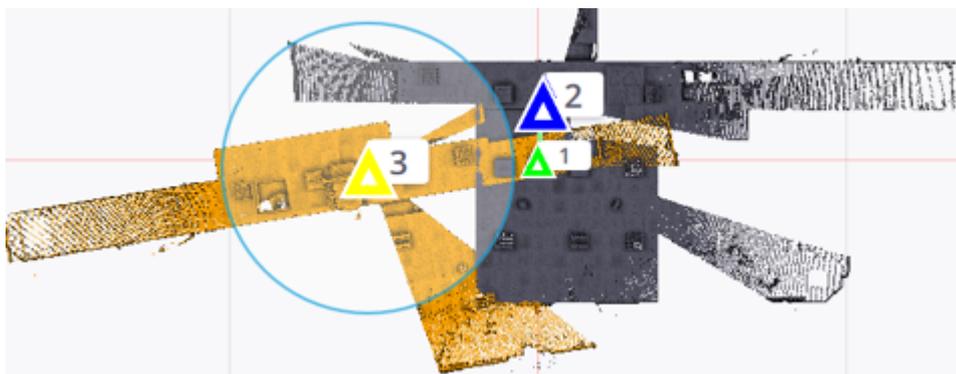
○ Drag the moving station's marker close to the reference station's marker.
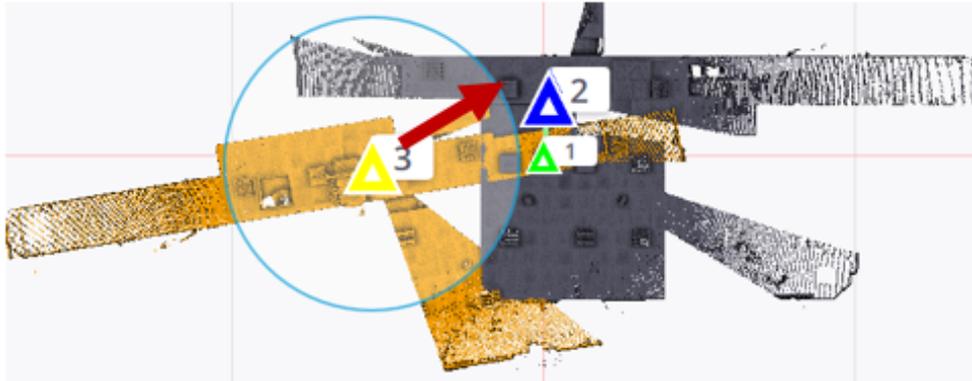
- If the moving station is not well orientated with the reference station, adjust its orientation relative to the reference station as follows:

   ○ Pick the ring manipulator, it becomes bigger and the moving station color changes to orange.
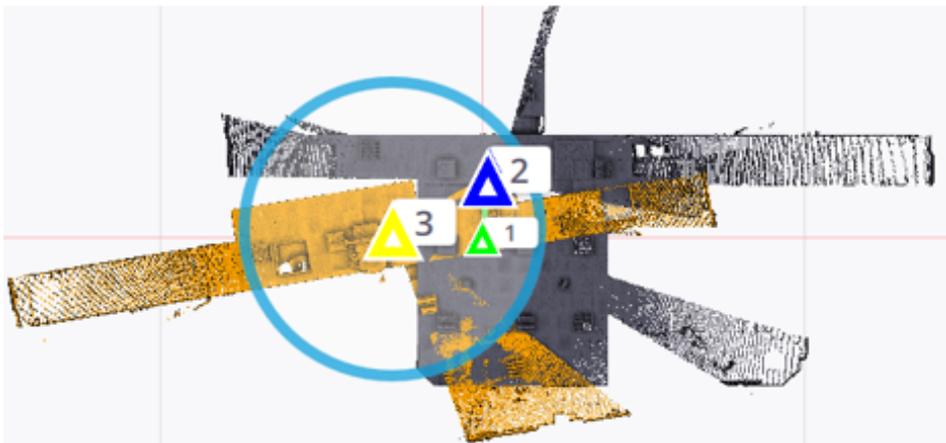
   ○ Drag the ring manipulator to rotate the moving station. Once done, release the ring manipulator. Both

the ring manipulator and the moving station resume their initial state.
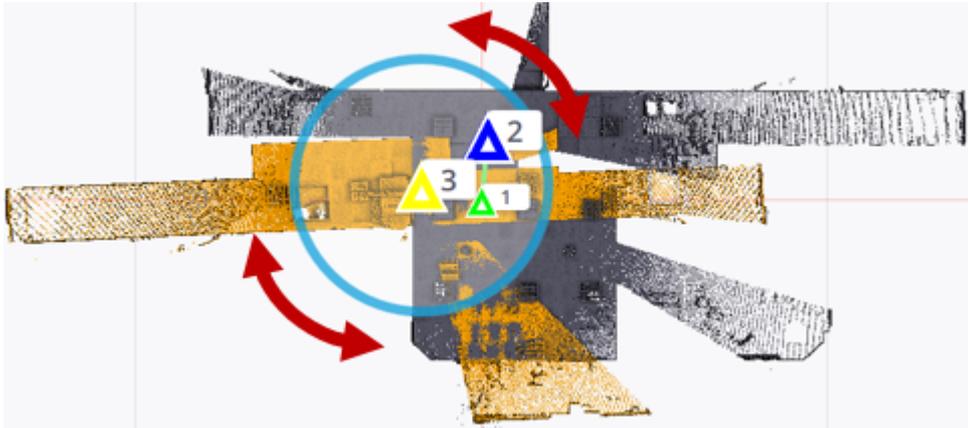
- Once the moving station is correctly positioned and orientated with the reference station, tap **Register** to register the two stations.
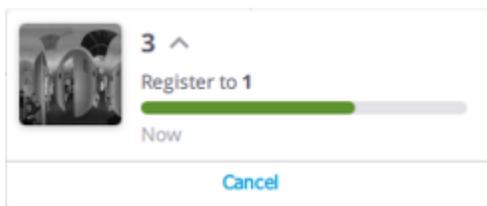
Optionally, tap **Cancel** from the popped-up notification (or **Undo**) to cancel (or undo) the registration.

> **NOTE –** Using **Create Link** ⊖ instead of **Register** does not register the two stations but only creates a link between them.

- Tap ✕ to close the **Manual Registration** toolbar.

Pick Two Pairs of Corresponding Points

Select two unlinked stations from the **Manual Registration** toolbar, one from the **Moving Stations** list and the other from the **Reference Stations** list, and tap ▯. In the side-by-side views, tap:

- Two pairs of corresponding points.

- A point to select it and tap a new position (in option).

- ↻ to reset the two pairs of corresponding points (in option).

- ↰ to undo the last defined point.

- **Register** to register the two selected stations.
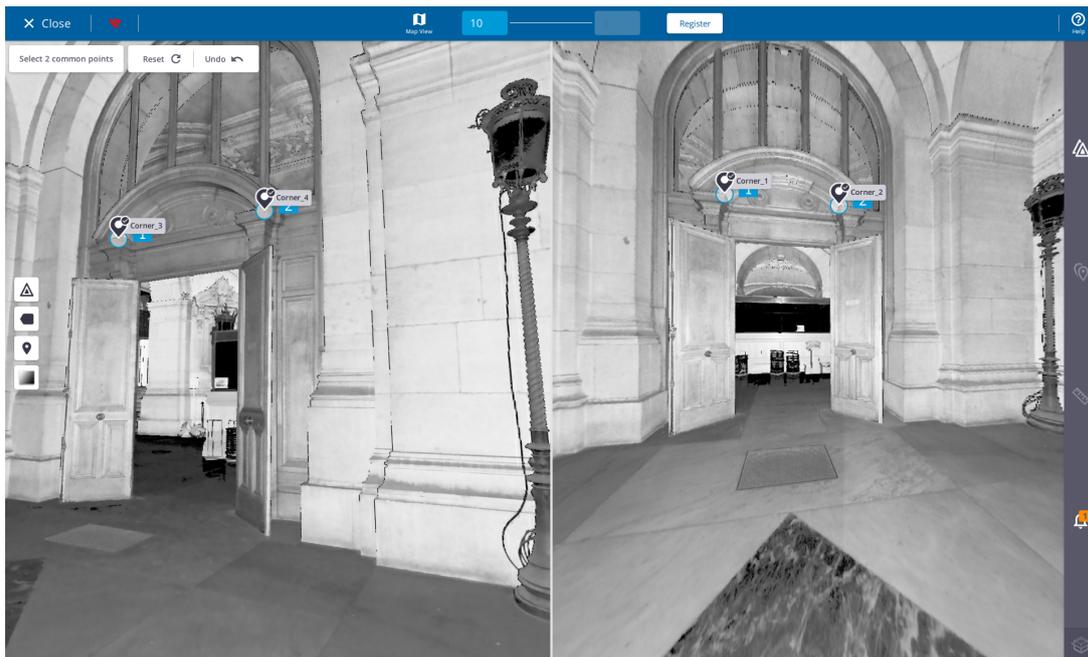
> **TIP –** You can use annotations (or precision points) in each station as corresponding points to register the stations. Pick around an annotation (or precision point) to snap to it.

> **NOTE –** If both selected stations have some area scans, they will not be displayed in each view.

> **NOTE –** If the two selected stations are linked, first tap **Break Link** .

Edit and Register Registration Sets

Two stations successfully registered together are linked with a registration link (see Edit Registration Links). A run of stations successfully registered two-by-two are put in a common registration set. If the registration has failed for a station of the run, a new registration set starts with the station inside. A registration set can be edited only within the **Manual Registration** tool.

> **TIP –** Use the ⚡ **Registration Set Color** option to render the points displayed in the **Map View** with one color per registration set (only outside the **Manual Registration** tool).

Modify the Position of a Registration Set

From the **Manual Registration** toolbar, select a station from a registration set and drag and drop the station to a new position. All the stations of the set are shifted as a whole to the new position (the registration links between the stations are preserved).
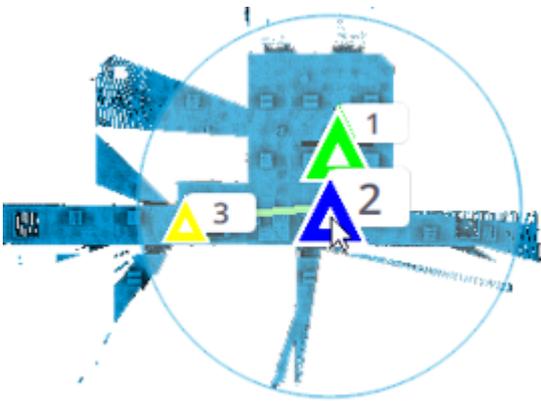
Rotate a Registration Set

From the **Manual Registration** toolbar, select a station from a registration set and rotate the ring manipulator. All the stations of the set are rotated around the selected station as a whole (the registration links between the stations are preserved).
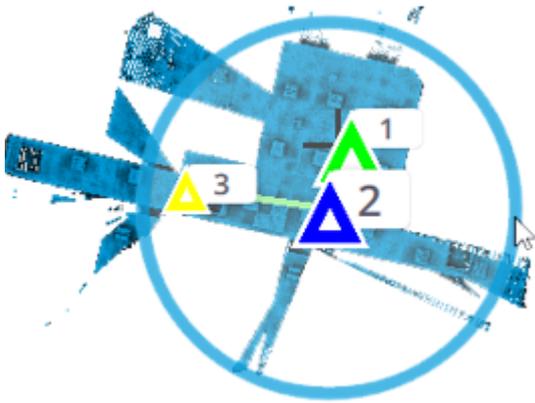
Register Two Registration Sets

In the **Manual Registration** toolbar, select two stations, one from each of the registration sets and proceed to either an automatic registration, or a manual registration.

Rename a Registration Set

In the **Stations List** panel, tap the pull-down arrow and choose **Reg. Set**.

1. Tap a registration set to select it and tap ✎ **Rename**.
2. Enter a new name and tap **Apply**. If the input name already exists, a warning pops up.

> **NOTE –** The entered name cannot contain any of the following characters: \:*?"<>|.

Edit Registration Links

Two stations that have been successfully registered together are linked with a registration link (from the moving station to the reference station). In the **Manual Registration** tool, you can:

- **BREAK THE REGISTRATION LINK OF A SET**:

  Select two stations from the same registration set, one from the **Moving Stations** list and the other from the **Reference Stations** list, and tap **Break Link** .
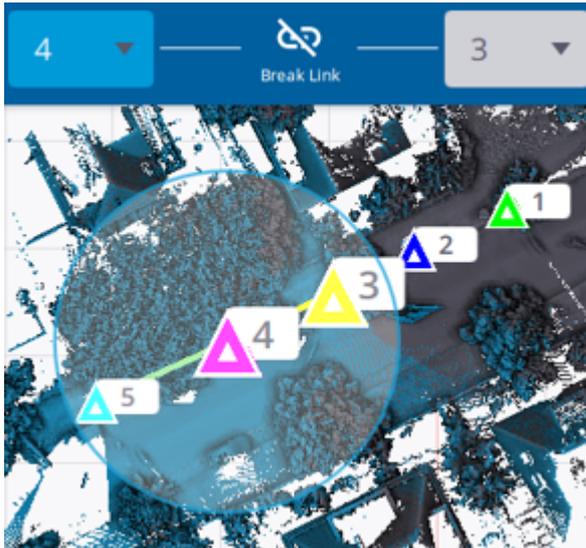
  Or

  In the **Map View**, tap a registration link and choose **Edit Link** from the pop- up menu. In the **Manual Registration** toolbar, the **Moving Stations** list and the **Reference Stations** list are updated to display the moving station and the reference station of the selected link. Tap **Break Link** .
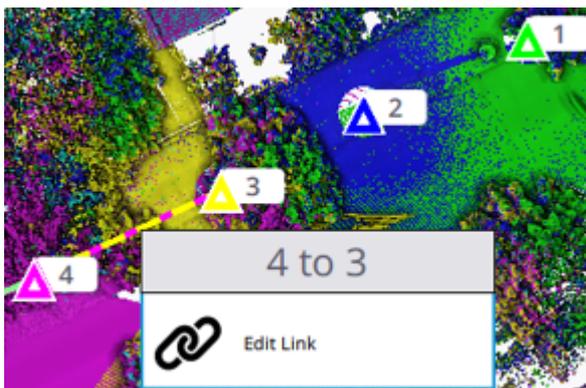
- **LINK TWO STATIONS MANUALLY**:

Select two stations from two different registration sets, one from the **Moving Stations** list and the other from the **Reference Stations** list, and tap **Create Link** 🔗. The two stations are linked together, the moving station is put into the registration set of the reference station (if it existed).

> **CAUTION –** Two stations linked with a registration link does not mean that they are registered together but only put in the same set.

- **LINK TWO REGISTRATION SETS WITH A LINK**:

Select two stations from two different registration sets, one from the **Moving Stations** list and the other from the **Reference Stations** list, and tap **Create Link** 🔗. The two stations are linked together, and the two sets are merged into one (the moving set into the reference set).

Process Images

Create Panoramas

A panorama results from the stitching of the captured images at a given position (station position). It may have two resolutions.

- **PREVIEW QUALITY**: This resolution uses a fixed distance, i.e. 20 meters, and does not apply any **Blending** and **Occlusion** corrections. It is fast and requires less computer resources. It is recommended for preview purposes.

    ○ **Blending** smooths discontinuities between images.

    ○ **Occlusion** avoids the duplication of objects.

    To create a preview quality panorama:

    ○ Automatically for each scan after acquiring the images, set the **Automatic Panorama Creation (Preview)** option to on. See ⚙ **Settings** > Images.

    ○ Manually for each scan, select **Details** > **Process Images** > **Create Preview Panorama** from the **Stations List** panel.
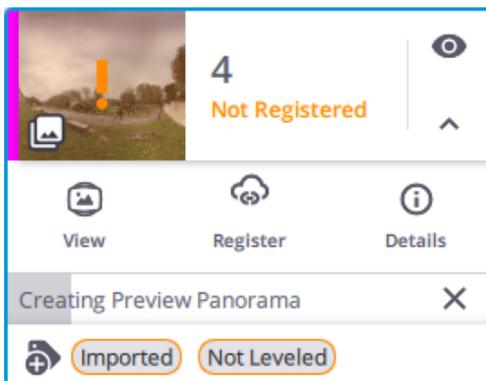
At the end of the step, a notification pops-up and summarizes the state of the step (succeeded (**Green**) or failed (**Red**)), as well as the duration.

> **NOTE –** Creating a preview quality panorama for a station will also create it for each scan (full dome and are) included in the station.

> **NOTE –**
>
> - The **Create Preview Panorama** option is grayed out after a **Preview Panorama** has been created.
>
> - The **Create Preview Panorama** option becomes available again if you:
>   - Add an area scan with images to the station.
>   - Retake some images for the station (only for an X12, see Retake Images).

- **HIGH QUALITY**: This resolution mode uses the point cloud to define a distance, and applies a **Blending** and an **Occlusion** corrections to a panorama to create. It is slower and requires more computer resources, but gives a better panorama result.

    To create a high quality panorama, select **Details** > **Process Images** > **Colorize Point Cloud** > **Create High Quality Panorama** from the **Stations List** panel.

A high quality panorama:

- Once created, overrides the preview quality panorama (if initially created).

- If created, is used to colorize a scan, meaning that you cannot create one without colorizing.

At the end of the step, a notification pops-up and summarizes the state of the step (succeeded (**Green**) or failed (**Red**)), as well as the duration.

> **TIP –** To create all panoramas in batch mode, see **Finalize a Project** > Create High Quality Panoramas.
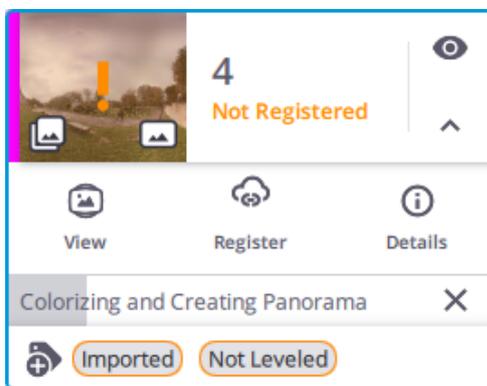
> **NOTE –** Creating a high quality panorama for a station will also create it for each scan (full dome and are) included in the station.

> **NOTE –**
>
> - The **Process Images** option is not available after colorizing, and creating a high quality panorama.
>
> - The **Process Images** option becomes available again if you add:
>   - An area scan with images to the station.
>   - Retake some images for the station (only for an X12, see Retake Images)

> **NOTE –** When exporting a project to the E57, PTX, LAS, POD and RCP formats, for each full dome scan with a high quality panorama, Perspective will export the high quality panorama as a 360° image in JPEG format in a specific folder (HQ Panorama Images). See Export a Project and Export Stations.

> **NOTE –** The ▲ **Panorama** option is available only if a panorama has been created, see **Visualize the Scan Data** > Station View.

Colorize Scans

You can colorize a single scan or a set of scans in batch mode.

> **NOTE –** Colorizing a station will colorize the full dome scan if it contains images and all area scans with images (or without images if full dome scan contains images).

- **SINGLE COLORIZATION**: From the **Stations List** panel, select **Details** > **Process Images** > **Colorize Point Cloud** to colorize a scan (the resulting **TZF** format file) with the color and /or exposure information found in the images (the resulting **TCF** format file).
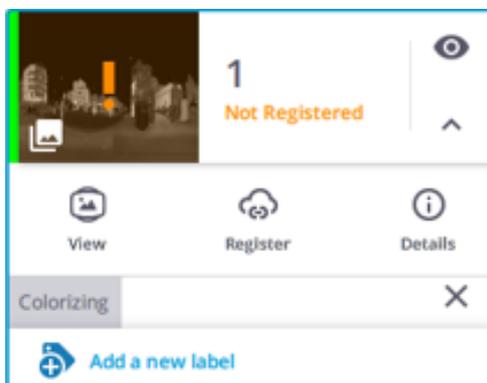
A notification pops-up and summarizes the state of the step (succeeded (**Green**) or failed (**Red**), as well as the duration.
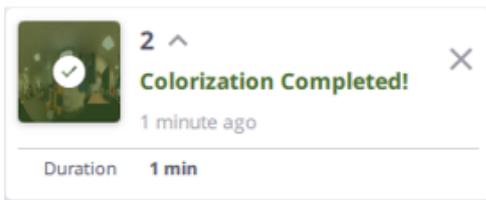
Below is a thumbnail of an uncolorized station:

Below is a thumbnail of a colored station:

- **BATCH COLORIZATION**: To colorize all scans in batch, see **Finalize a Project** > Colorize Point Clouds.

CAUTION – A scan can be colorized only once. After colorizing, the **Colorize Point Clouds** option becomes dimmed in the **Process Images** (or **Finalize & Export**) dialog. It becomes available again each time a new area scan with images has been added to the station.

TIP – Select the **True Color** rendering from the ◆ **Options** in the **Map View** to view the colorization applied to the scan data.

View and Retake Images

X7 & **X9**

The images taken by a scanner for a given station are stored in a **TCF** format file. There are altogether fifteen (or thirty-six) images laying on three rows (or six) and twelve columns, and numbered from zero to fifteen (or thirty-five).

4.1		4.2		4.3		4.4		4.5		4.6	
3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10	3.11	3.12
2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	2.11	2.12

- A column corresponds to one acquisition position of the three cameras, and there are six (or twelve) positions at all.
- A row corresponds to the six (or twelve) acquisition positions of a camera; top row for the top camera, middle row for the middle camera, and so on.

The resolution of each image is 3840 x 2748 pixels, and all of them can be browsed in a specific viewer.

X12

For a given station, the scanner takes forty-two images when it captures a full dome scan and saves them in a TOI format file. You can review the taken images for the station in a viewer and determine if any images should be retaken due to obstruction or bad lighting.

In the viewer, the images lay on four rows and twelve columns (only six images for the first row (zenith)).

- A column corresponds to one acquisition position of the camera (30 degrees), and there are twelve positions at all.
- A row corresponds to the four acquisition positions of the camera; top row for the top camera, middle row for the middle camera, and so on.

The resolution of each image is 1200 x 1600 pixels.

View Images

If you are not connected to the scanner, or the scanner has moved from the position the images have been taken, or the current station is not the last station, you can only view the taken images:

1. In the side panel, tap ⚠. The **Stations List** panel displays.
2. Tap the **Details** icon of a station. The **Station** panel displays.

3. Tap **View Images**.
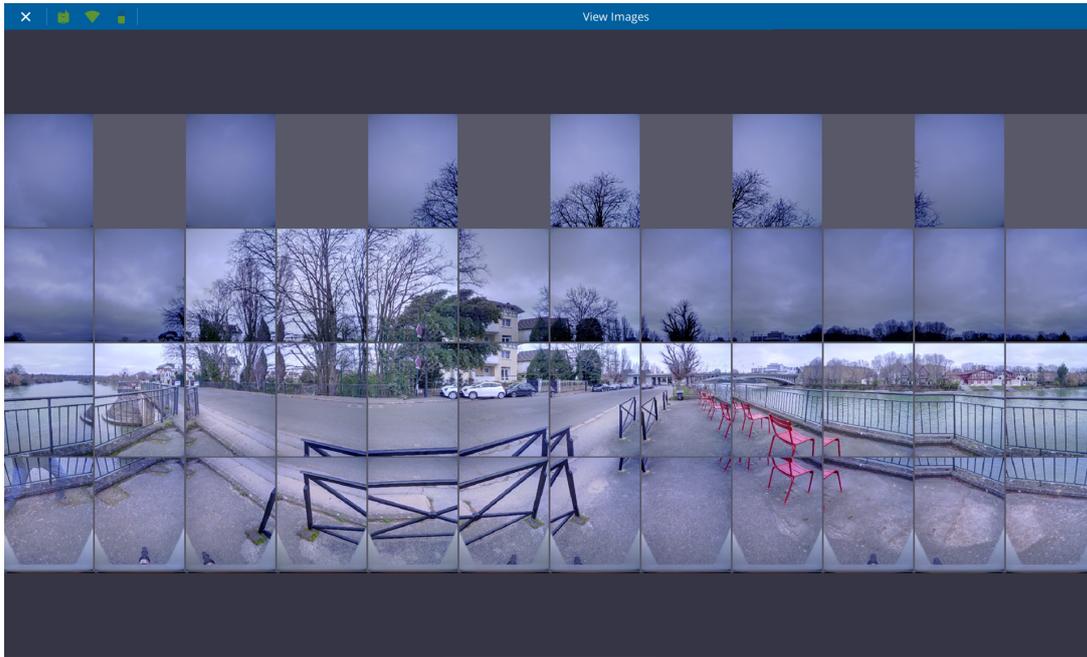
Retake Images

- **From Perspective**: To retake an image or multiple images, you should be connected to your scanner and it should not be moved from the position the images have been taken, and the current station is the last station.
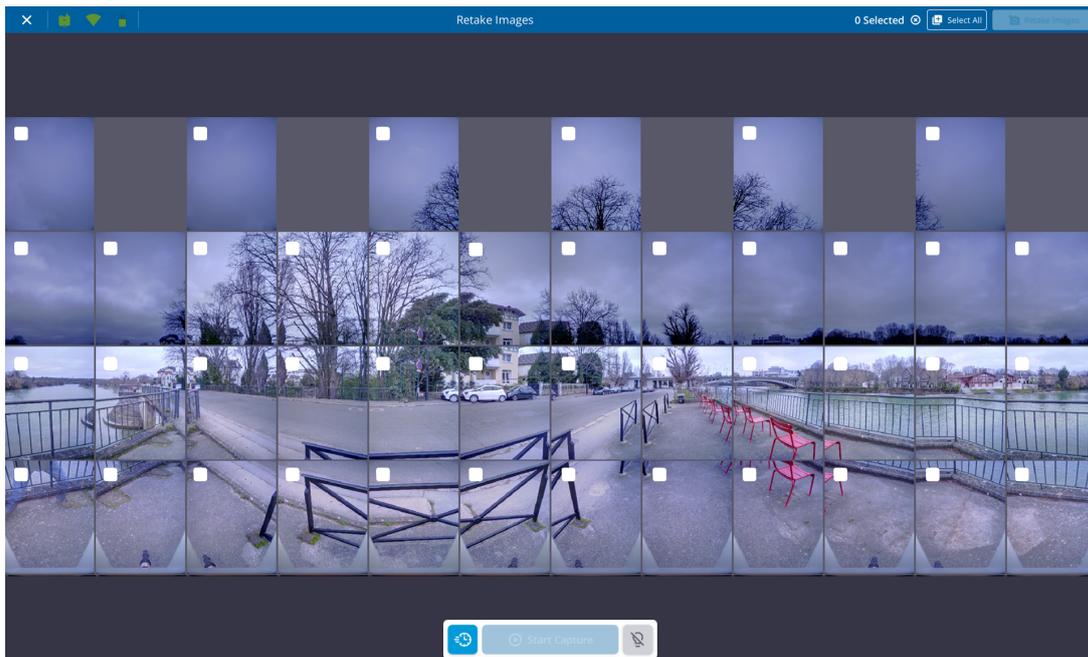
1. In the side panel, tap ⚠. The **Stations List** panel displays.

2. Tap the **Details** icon of a station. The **Station** panel displays.

3. Tap 🖼 **Retake Images**. The viewer opens and displays the taken images.

4. Tap 📷 **Retake Images** and select an image or select all ⊞.

5. Optionally, toggle on the **SmartLight** and/or the **Fast Mode**.

6. Tap ▶ **Start Capture**.

- **From the Scanner On-board Application**: Load the raw images in the viewer and tap 📷 **Retake Images**. Select some images (or select all) and press ▶ **Start Retake**. Optionally, toggle on the ♀ **SmartLight** and/or ⏱ **Fast Mode** prior to retaking the images.

  ◦ If the tablet is connected to the scanner, Perspective will download the new images.

  ◦ If the tablet is not connected to the scanner, at the next connection to the scanner, Perspective will prompt you to download the new images.

> **NOTE –** Refer to the Trimble X12 user guide for full instructions.

The new images will replace the old ones in the viewer and in the TOI format file.

> **NOTE –** 📷 **Retake Images** is dimmed in case.
>
> - A scanning process is ongoing (area scan, full scan, images, etc.).
>
> - An image related algorithm is running on the current station (colorization, or panorama).
>
> - The full dome scan of the station is already colorized.

Check Graphically a Registration Quality

Once a registration between stations has been performed, beside reviewing the registration results (see Display Refinement Report), you can check the quality graphically. Do one of the following:

Hide all Stations Except Those Near a Specified One

Choose ⊚ and select a station. The application hides all other stations except the selected one and the station(s) close to the selected one. The number of nearest stations has to be defined in ⚙Settings > General.
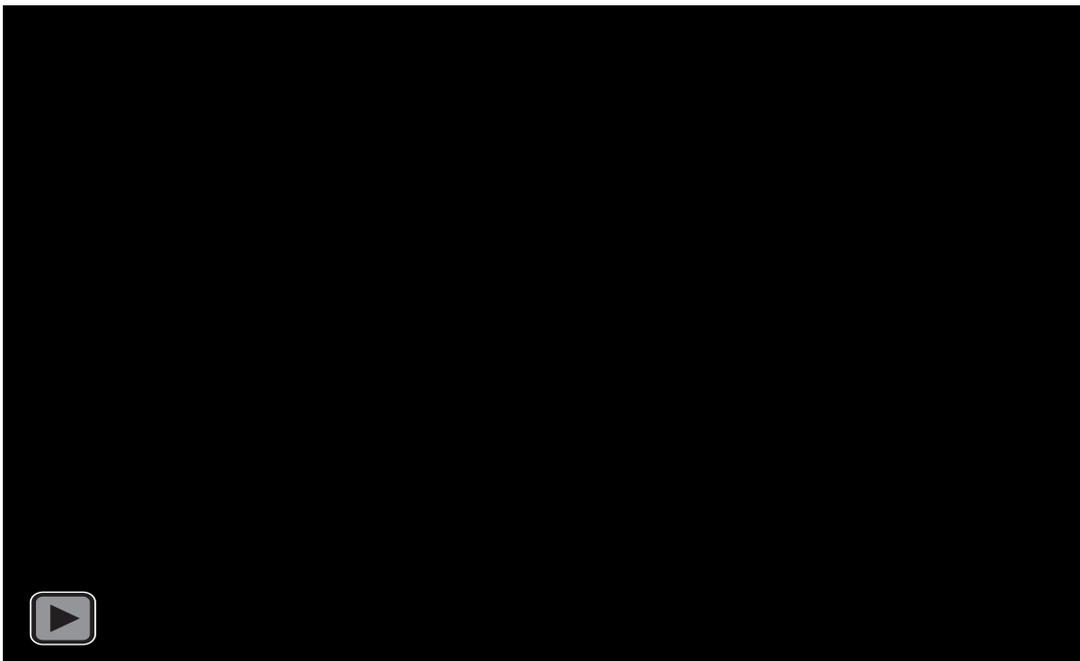
Tap ◉ to reload all stations.

Clip and Zoom to Explore an Area of Interest

Tap 🔍, set a value in meter (or foot) in the **Adjust Magnifier Size** and pick a point on the scan data in the **Map View** (or in the **Station View**). The picked point defines the center of a clipping box and the application loads more points inside the clipping box.

- If one station is displayed in the **Map View**, only points from that station are loaded in the clipping box in the **Map View**.

- If one station is displayed in the **Station View**, the application displays all stations in the **Map View**, and loads points from all stations (including hidden ones) in the clipping box.

The minimum and maximum sizes of the clipping box are 0.1 m and 10 m (or 0.25 ft and 32.81 ft).

Tap ✚ or ━ to increase or to decrease the step size by:

- 0.5 m (or 1 ft) when the value is between 0.5 m (or 1.64 ft) and 9.5 m (or 31.17 ft).

- 0.1 m (or 0.25 ft) when the value is below 0.5 m (or 1 ft).

Tap ✚ to set the maximum value (10 m or 32.81 ft) when the value is above 9.5 m (or 31.17 ft).

Tap ━ to set the minimum value (0.1 m or 0.25 ft) when the value is below 0.2 m (0.5 ft).
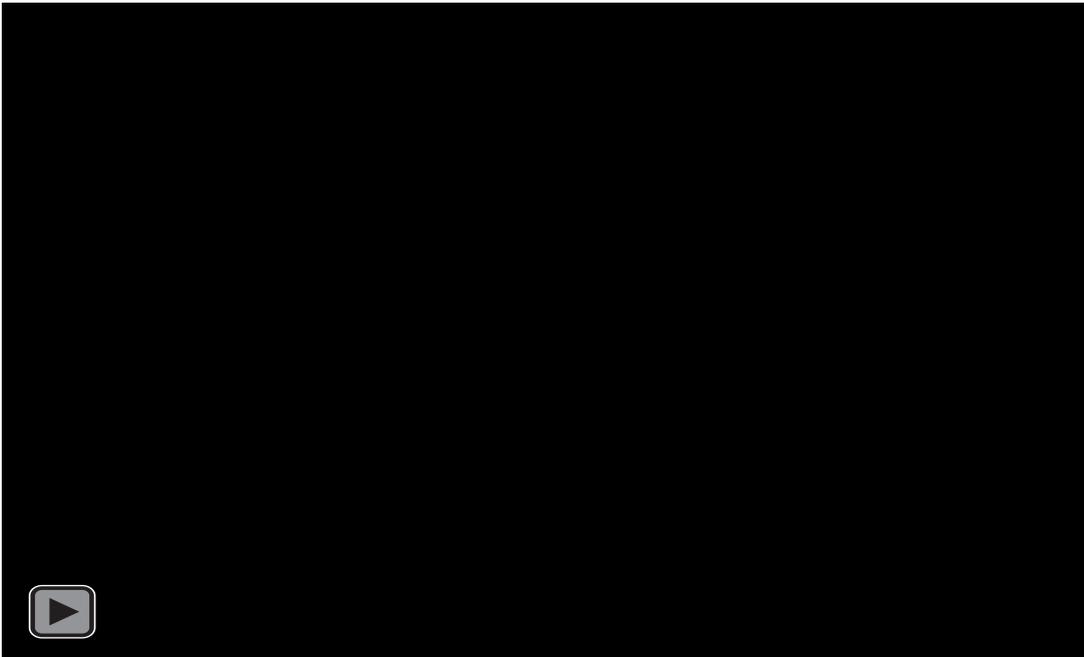
Tap 🔍 to reload all the scan data.

Limit Box

The ⬡ **Limit Box** tool lets you create a small section on the displayed point cloud for getting a clearer view of a specific area or for helping you to register the data or for evaluating the result. It is just purely a visualization mode in 2D or 3D.

Define a Region

Tap ⬡ **Limit Box**. A limit box with manipulators (handles) is displayed either centered in the actual view or at the center of the point cloud.

Manipulate the limit box:

- In **2D**: Use one finger (or the left mouse button) to pan.

- In **3D**: Use one finger (or the left mouse button) to orbit, two fingers (or the right button) to pan, two fingers (or the mouse wheel) and stretch and pinch (or scroll) to zoom in (or out).

  > **TIP –** Tap ⊕ **3D View** to activate the 3D mode.

Use a handle to resize the limit box or to change its orientation:

- ↻ **Rotation Handle**: Drag the handle to rotate the limit box around its vertical axis and centered on the limit box.

- ○ **Extent Handle**: Drag the handle away from (or toward) the center of the limit box to increase or decrease the size of the limit box in one direction.

NOTE –

- In **2D**: The **Extent Handles** are displayed on each line of the limit box. The **Rotation Handle** is displayed, only in the**Top View**.
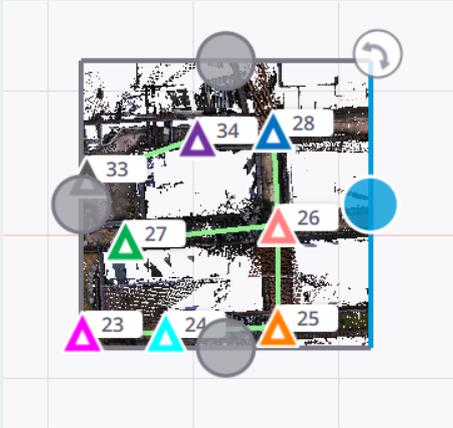
- In **3D**: The **Extent Handles** are only displayed on the visible faces of the limit box. The **Rotation Handle** is displayed, and disappears when you are close to the **vertical.**
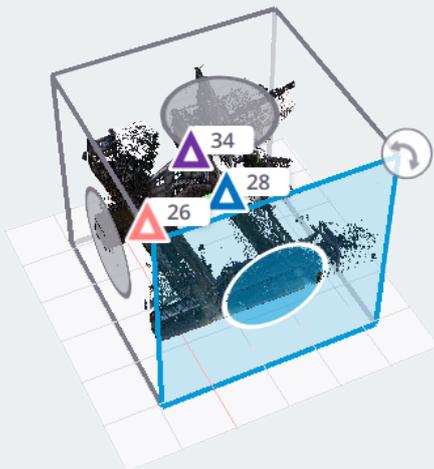
- In **2D** and **3D**: The selected handle is highlighted in blue as well as the face that will be modified.

Tap 👁 to hide (or ⌗ to display) the limit box.

Tap ↺ to restore the last saved limit box.

NOTE – The first time the **Limit Box** tool opens on a project, the **Show Previous Limit Box** icon is disabled as no limit box has been defined initially. Once you set and adjust a limit box in your project, it will retain its position and size after you close and reopen the **Limit Box** tool, the project, or Trimble Perspective.

> **CAUTION –** When you open and close the **Limit Box** tool without reloading the last Limit box, it will erase and replace the last selection with the new one.

> **NOTE –** The **Limit Box** tool is disabled in **Station View**.

The **Limit Box Vertical Extent** is to define the height of the limit box. Tap in the **Limit Box Vertical Extent** field to edit the value.

Use the slider to move the limit box along its vertical axis with a constant vertical extent value.

Export a Region

Tap [↑] to export a defined region to a single LAS (1.2 or 1.4) or E57 non-gridded format. By default, the exported file is named after the project name with the .las or .e57 extension.

Tap ••• to define a folder in which the file will be stored.

If there are some high-quality panoramas in your project, Perspective does not export:

- These high-quality panoramas as 360° JPEG images.
- And the registration information (location and orientation) of these high-quality panoramas.

> **NOTE –** Hiding (or showing) a station has an effect on the export. Inside a defined region, only displayed stations will be exported.

> **CAUTION –** Exporting to LAS 1.2 (or 1.4) has a limitation of 4.2 billion points (or 18 quintillion points) for a single file. This corresponds to a huge disk space. For technical limitations, the approximation when exporting a limit box (region) is based on the whole scans. If a LAS format file exceeds the limit, it will fail to be exported. Make sure you have sufficient space on your export path.

8

Organize, Create Points & Measure

To organize the data in your project, use labels. They are a quick and flexible way to flag the captured data. Optionally, annotate the scan data by adding points or measuring some with the laser pointer, or perform some measurements.

Add Labels

You can create (or select) and assign a label to a station, delete one, sort the stations to only display those having the same label. A label once created is added to those related to the scanner status: "Leveled", or "Not Leveled", "Imported", etc.

Assign Labels Before Scanning

1. Tap ⬡ **Labels**. The **Labels** panel pops up.

2. Tap in the **Labels** field.

3. If there is no label, enter a name in the **Labels** field, and tap **Enter**.

4. If required, repeat the previous step to add another label. All created labels display below the **Labels** field.
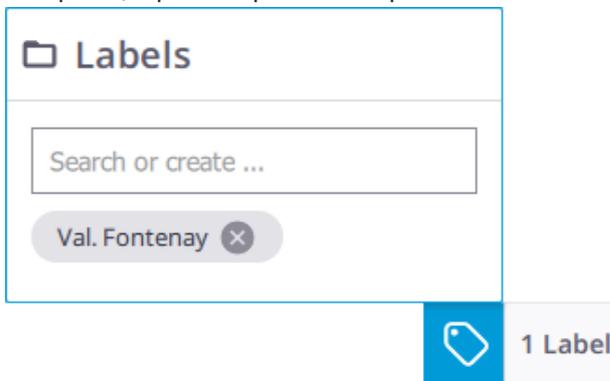
5. If there are some labels, a list pops up.
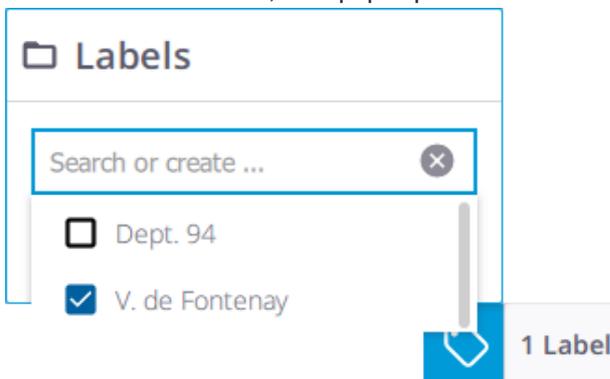
6. Choose a label from the list. The checkbox when is:

   ○ **Checked** means "**Assigned**", tap to unassign.

   ○ **Unchecked** means "**Not Assigned**", tap to assign.

7. Tap ⊗ inside the **Labels** field to close the list.

Assign Labels After Scanning

1. Tap ⚠ **Stations List** to open the panel.
2. Tap 🔗 **Add Label** from a station card.
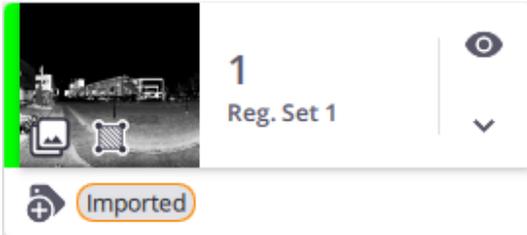
3. Enter a name in the **Labels** field, and tap **Enter** to create a new label.
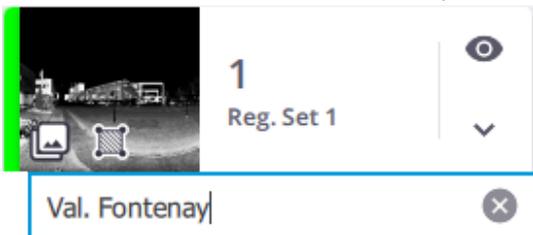
4. If required, repeat the previous step to add another label.
5. Or choose a label from the drop-down list (if there are some). A checkbox when is:
   ◦ **Checked** means "Assigned", tap to unassign.
   ◦ **Unchecked** means "**Not Assigned**", tap to assign.
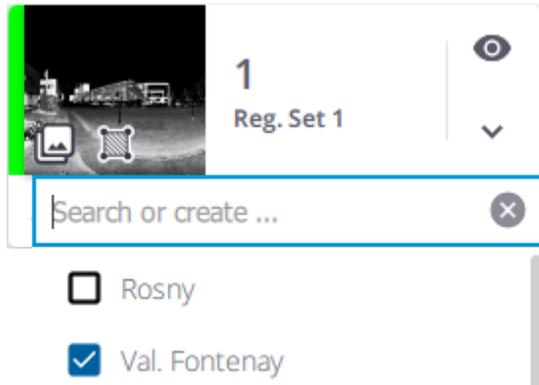
5. Or tap **Details** > **Labels** and create a new label or select one from the list.
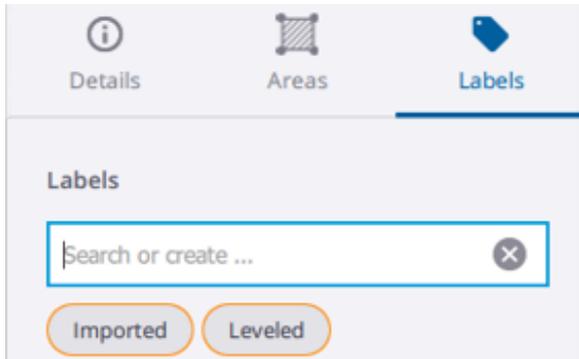
> **NOTE –** Tap ⊗ inside the **Labels** field to close the list.

Delete Labels

Tap ⚠ **Station List** to open the panel. Do one of the following:

- Unassign a label until it is no longer assigned to any station.
- Tap **Details** > **Labels** and ⊗ beside a label (single deletion).
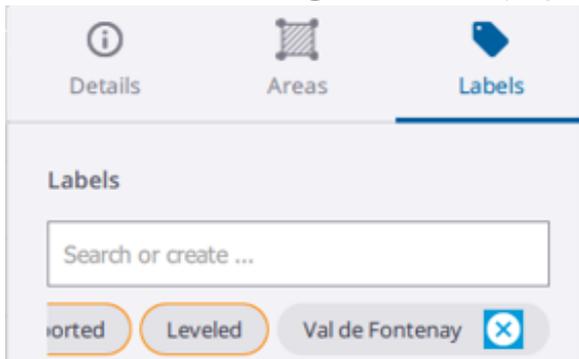
- Tap **Details** > **Labels**, and in the **Labels** field. Select labels to multi-delete.

Sort Stations by Labels(s)

1. Tap ⚠ **Station List** to open the panel.
2. Tap a label name (or a set of label names) in a station card. Stations out of the filtering range are hidden in the **Stations List** panel and in the **Map View**.

3. To reload the hidden stations, tap the X icon beside the name of the label to remove from the filtering.

Manage Stations

Do one of the following:

Display Station Properties

For each station, there are two levels of properties. From the **Stations List** panel, tap a station card to select the station.

> **TIP –** Tap ⌄ in a station card to select the station.

- **SUMMARIZED PROPERTIES**: The most relevant information is displayed: station name, registration set name, label(s) (if available), images (**A**) (if captured), area scan(s) (**B**), panorama (**C**) (if created), and colorization (**D**) (if applied to the scan) as well as a quick access to the most used features (⌖ **Register Station**, ⌂ **Station View** (or ▯ **Map View**), and ⊕ **Add Label**).
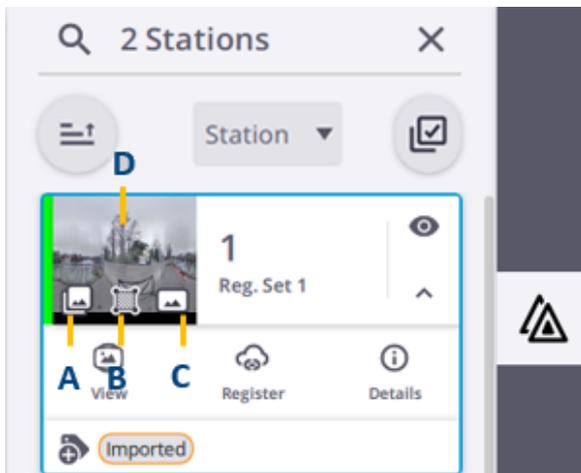
Tap:

◉ to display the current station, and all the related area scans.

◑ to display the hidden scans (full dome or area) of the current station.

◌ to hide the current station and all the related area scans. Hiding all displayed stations also hides all the station positions, labels, registration links and all created annotation and precision points (see Points Tool).

- **DETAILED PROPERTIES**: Tap ⓘ **Details**:

  ○ To access the hidden features (**Register Station**, **View Images** (or **Retake Images**) for X12 only, **Export Station**, **Process Images**, and **Delete**).

  ○ And ⓘ **Details** to view the properties in detail (registration status, leveling status, scanner's model (X7, X9 or X12) and configuration (Core or Premium) for X9 only, scan duration, scan mode, etc.).
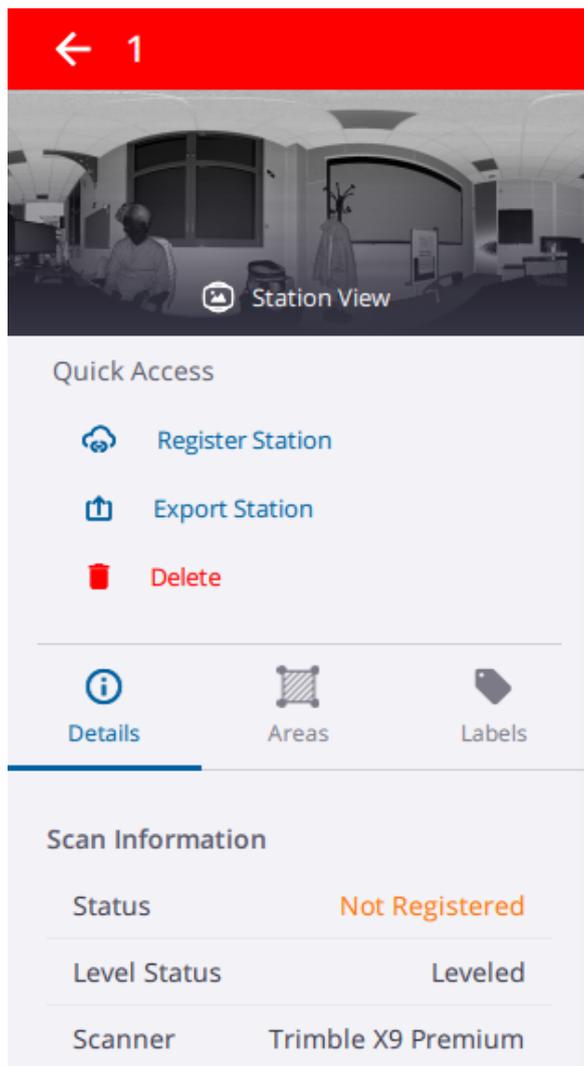
- And ▨ **Areas** to display (or hide) all available scans (full dome scans and/or area scans). Each area scan can be viewed (either in the **Map View** or in the **Station View**) or deleted.
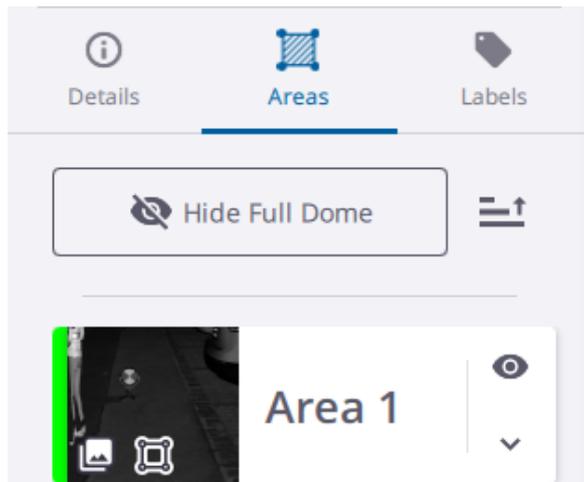
Tap 👁️‍🗨️ to hide the current full dome scan, or 👁️ to display the current full dome scan.

Tap ∨ to expand an area scan card, and choose:

🖼️ and 📘 to switch between the **Station View** and the **Map View**.

◉ to center the current area scan to the center of the **Station View**.

ⓘ to view the properties of the current area scan and to delete it

  ○ And 🏷️ **Labels** to search or create new labels (see Add Labels):
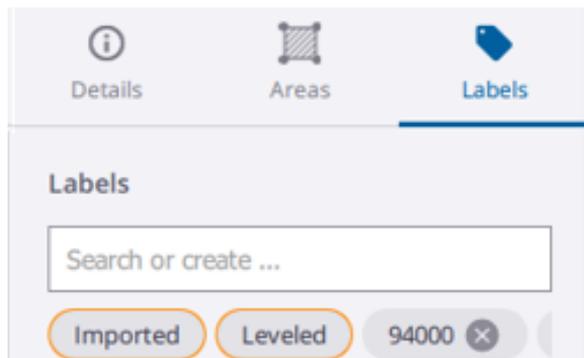
Filter Stations

In the **Stations List** panel, tap the pull-down arrow and choose:

- **STATION** to filter the stations per station name, in ascending (or descending) order.
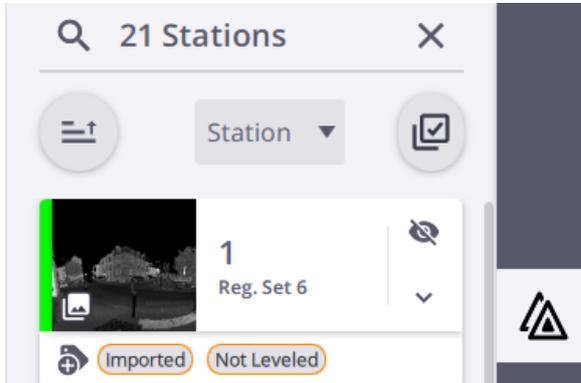
> **NOTE –** When you hide (or display) a station from this panel, you hide (or display) all the contents: scan, markers (position and label), registration link and created annotations or precision points.

- **REG. SET** to filter the stations per registration set, in ascending (or descending) order. Expand a registration set to see all the stations in the set.
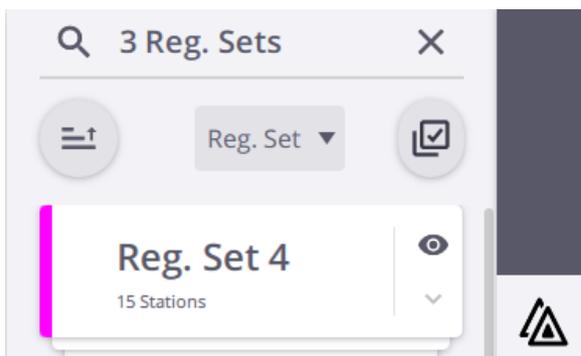
> **NOTE –** When you hide (or display) a registration set from this panel, you also hide (or display) all the contents of the set (scans, station markers (positions and labels), registration links and created annotations or precision points in the **Map View** and **3D View** and all markers (positions and labels) and created annotations or precision points of the set in the **Station View**.

Find a Station

In the **Map View**, tap the ▲ **Marker** of a station and choose ⚠ **Find Station** from the pop-up menu.

- **The Stations List** panel opens (if it is closed).

- The **Station Details** panel closes (if it is opened).

- The **Area Scan** tool closes (if it is opened).

- The station becomes the selected (current) station in the **Stations List** panel.

NOTE – The **Find Station** feature is not available when the ☑ **Multi-Selection** is enabled in the **Stations List** panel. See Export Stations.

Delete Stations

When you delete a station from a project, Perspective deletes all the related scans (full dome and area(s)).

- **X7** & **X9** - Project file(s) (TZF, and/or TCF, and/or TPF) from the database and/or (TZF, and/or TCF) from the ScanData folder in the memory card*.

- **X12** - Project file(s) (TZF, and/or TOI, and/or TPF) from the database and/or (TOS, and/or TOI) from the internal memory of the scanner*.

- Any associated points. If these points have been matched with control points, consider to georeference the project again.

NOTE – (*) Only if the **Delete from Scanner** option has been chosen and the scanner connected to the controller.

Stations are named following a sequence, starting at one for the first station and incrementing in one digit for the second station, etc. When you delete **Station N**, the sequence is not disrupted, meaning that the next station is **Station N+1**.

To do one of the following:

- In the **Map View**, tap ▲ to display the pop-up menu and choose 🗑 **Delete**.
- In the **Stations List** panel, tap ⓘ to display the properties of a station, and tap 🗑 **Delete**.
  - Tap ⓘ to display the properties of a station, and tap 🗑 **Delete**.
  - Tap ☑ to open the **Stations Selection** tool, select one or more stations, and tap 🗑 **Delete**.

CAUTION – When you delete a station from a project, you delete its related scan, markers (position and label), registration link and created annotations (or precision points) and associated control points from any view.

NOTE – You can delete all existing stations except the one being captured.

Delete Area Scans

When you delete an area scan from a station, Perspective only deletes the area scan.

- **X7** & **X9** - Project file(s) (TZF, and/or TCF) from the database and/or from the **ScanData** folder on the memory card*.

- **X12** - Project file(s) (TOS, and/or TOI) from the database and/or from the internal memory of the scanner*.

NOTE – (*) Only if the **Delete from Scanner** option has been chosen and the scanner connected to the controller.

Area scans are named following a sequence, starting at one for the first area scan and incrementing in one digit for the second area scan, etc. When you delete **Area N**, the sequence is not disrupted, meaning that the next area scan is **Area N+1**.

To delete an area scan:

1. From the **Stations List** panel, display the properties of a station by tapping ⓘ **Details**.
2. Tap ▨ **Areas**.
3. Tap to expand an area scan card and choose 🗑 .

Colorize Scans

To colorize a full dome scan, tap 🖼 **Process Images** from the **Stations List** panel. See Colorize Scans.

Create Panoramas

To create a high quality panorama from a full dome scan, tap 🖼 **Process Images** from the **Stations List** panel. See Create Panoramas.

Points Tool

An annotation is a picked location in the **Station View** while a precision point is measured as a single point by the scanner indicated by the laser pointer (see Laser Pointer). Both can be matched with a control point for georeferencing the project. Once created, an annotation and a precision point can be edited.

Add Points

1. Tap ⊙ **Points Tool**. With the **Points** panel opened, tap ✚ **Create New**.
2. Choose one of the following:

Annotation

No connection to the scanner but only a scan in your project is required to create an annotation.

1. Input a name in the **Name** field.
2. Optionally, input a comment in the **Description** field.
3. Optionally, take a picture with your controller to illustrate the annotation to create (see Illustrate With a Picture) or choose an existing picture.
4. Optionally, check the **Use For Georeferencing** option to set the annotation to create as a georeferencing point. See Georeference a Project.
5. Tap a point and if required, drag and drop the tapped point to a new location.
6. Tap **Create Point**. Once created, an annotation displays as:

   - A pin in the **Station View**, with a label (annotation's name).
   - A card in the **Points** panel, with the annotation name, the name of the station it belongs to, and

the illustrated picture.

> **NOTE –** In the **Preview Panorama** (or **High Quality Panorama**) ◩ mode, you cannot tap a point to create an annotation.

Precision Point

A connection to the scanner and a scan are required to create a precision point.

> **NOTE –** With the Indoor mode, the **Precision Point** type is:
>
> - Enabled with a scan acquired with an X9.
> - Disabled with a scan acquired with an X7.

1. Input a name in the **Name** field.

2. Optionally, input a comment in the **Description** field.

3. Optionally, take a picture with your controller to illustrate the precision point to create (see Illustrate With a Picture) or choose an existing picture.

4. Optionally, check the **Use For Georeferencing** option to use the precision point to create as a point for georeferencing the project. See Georeference a Project.

5.   And input a height in the **Target Height** field. The position on the ground of the measured point is displayed.

> **NOTE –** The **Target Height** field is only available for leveled scans, and when the **Use For Georeferencing** option has been checked.

6.   If required, turn on the laser pointer to aim the point to measure (see Laser Pointer).

7.   If required, zoom in and tap **Scan Point**. Perspective displays the distance to the precision point once the measurement is done.

8.   Tap **Create Point**. Once created, a precision point displays as:

-   A pin in the **Station View**, with a label (precision point's name).

> **NOTE –** If a **Target Height** has been input, the precision point is created on the projected position on the ground. Otherwise, no.

-   A card in the **Points** panel, with the precision point name, the name of the station it belongs to, and the illustrated picture.

> **NOTE –**
>
> - A measurement will fail when it is done inside a none-scanned area.
>
> - The scanner may execute a field calibration process before each measure.
>
> - In the **Preview Panorama** 🖼 mode, you cannot create a precision point while in the **High Quality Panorama**) you can.

Below are the different representations of a point once created:

📍 annotation.

📍 annotation, set for georeferencing use.

📍 annotation, set for georeferencing use and matched with a control point and the distance to the control point is under the defined **Georeference Error Tolerance**.

📍 annotation, set for georeferencing use and matched with a control point and the distance to the control point exceeds the defined **Georeference Error Tolerance**.

📍 precision point.

📍 precision point, set for georeferencing use.

📍 precision point, set for georeferencing use and matched with a control point and the distance to the control point is under the defined **Georeference Error Tolerance**.

📍 precision point, set for georeferencing use and matched with a control point and the distance to the control point exceeds the defined **Georeference Error Tolerance**.

> **NOTE –** The **Georeference Error Tolerance** can be changed. See **Settings** > Units or **Report** > Edit.

For matched points, 🔗 is displayed in the card with the **Control Point** name and the distance to the **Control Point**.

Display and Hide Points

To display (or hide) a point from all views (**Map View**, **Station View** and **3D View**), select it from any view (or from the **Points** panel):

- In the current view, the selected point is displayed bigger than the others, and a panel pops up showing its name, the thumbnail of the attached picture and the **View Details** command.

- In the **Points** panel, the selected point is surrounded by a blue frame, and its card expands showing hidden commands.

- Tap:

  👁 to hide the selected point from all views.

  👁 to display the selected point in all views.

⬚ to center the selected point in the current view.

⬛ to switch from the **Station View** display to the **Map View** (or **3D View**) display.

🖼 to switch from the **Map View** (or **3D View**) display to the **Station View** display.

> **NOTE –**
>
> - 🔗 Select only appears when the **Points** panel is opened in the **Georeferencing** tool. It enables you to select a point to match (or unmatch) with a control point.
>
> - In the **Preview Panorama** 🖼 mode, all created annotations stay displayed and all created precision points are hidden (in the **Points** panel, 👁 and ⬚ are grayed-out).
>
> - In the **High Quality Panorama** 🖼 mode, all created points whether annotations or precision points are displayed.

Edit Points

Select a point from any view (or from the **Points** panel) and tap **Details** (or **View Details**) to display its properties.

Tap **Edit**. From the **Edit Point** panel:

- Turn the **Use For Georeferencing** option on or off.
- Change the **Target Height** value (only for precision points for which the **Use For Georeferencing** option has been turned on, and the scan leveled).
- Change the name.

- Change the description.

- Replace the attached picture with a new one. First, remove the previous picture by tapping **Remove Image** and then attach a new one.

- Not modify the position.

Once done, tap **Save**.

> **TIP –** To unmatch a pair of control point and annotation (or precision point), turn the **Use For Georeferencing** option off. See Edit the Matches.

Delete Points

To delete a point from all views, select it from any view (or from the **Points** panel) and tap **Delete** (or **Details** or **View Details** to display its properties. Once opened, tap **Delete**.

> **NOTE –** Deleting a matched annotation (or precision point) does unmatch it from its matched control point. See Edit the Matches. Consider to georeference the project again after deleting.

Sort Points

Created points can be sorted by **Point Name** or **Station Name** in **Ascending Order** (or **Descending Order**).
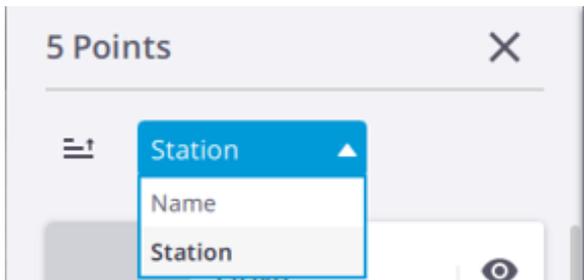
Measurement Tool

The ⬙ **Measurement Tool** lets you measure the 3D position of a point, a distance between two points, or an area and perimeter drawn by several points. These points need to be picked on the scan data in any view (**Map View**, **Station View** and **3D View**).

Measure

A Single Point

The ⬙ **Single Point Measurement** lets you measure the 3D position of a point on the scan data. Tap a point in any view. The distance from the scanner origin to the measured point is displayed when you are In the **Station View**:

N 1.403 m
E 0.661 m
El 2.518 m
Distance 2.957 m
Station 1

A (Slope) Distance

The ⬈ **(Slope) Distance Measurement** lets you measure a distance between two points and the resulting slope in percentage. Tap two points:

- In the **Map View**, in **Top View** to measure a distance.

  Distance 47.415 m
  Top View

- In the **Map View**, in **Front View**, or **Right View** to measure a slope distance.

  Distance 3.100 m
  Slope -66.04%
  Right View

- In the **Station View** to measure a slope distance.

- In the **3D View** to measure a slope distance.

> **NOTE –** A slope percentage can be positive or negative, depending on the order of the points picked on the slope.

A Horizontal Distance

The ↔ **Horizontal Clearance Measurement** lets you measure a 2D distance in the **X Y** plane (or **North East** plane). Tap two points in the **Station View**.

The measurement is performed between the first point and the projection of the second point in the **X Y** plane (or **North East** plane).

A Clearance Elevation Axis

The ↕ **Vertical Clearance Measurement** lets you measure a 2D distance along the **Z** axis (or the **Elevation** axis). Tap two points in the **Station View**.
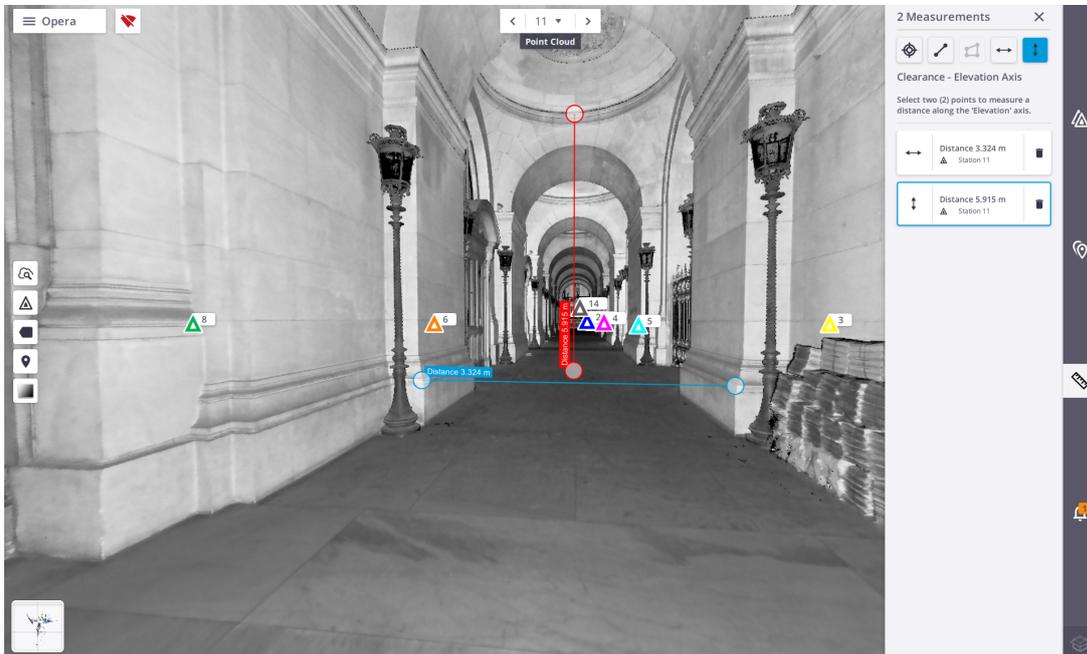
The measurement is performed between the first point and the projection of the second point along the **Z** axis (or the **Elevation** axis).

An Area and a Perimeter

The ⬠ **Area Measurement** lets you measure an area and a perimeter. Tap at least three points in the **Map View**.

The results display in any view and are stacked by measuring order in the **Measurements** panel. The following information is included where applicable:

- The station inside which the measurement has been done.
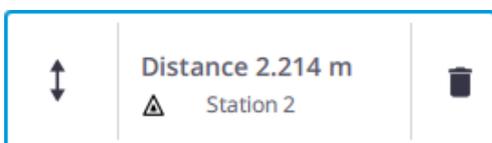
- The view from which the measurement has been done.

Area 4.26 m2
Perimeter 8.372 m
Right View

> **NOTE –** A measurement in progress (or a selected measurement) is highlighted in red in the viewers, and its card is surrounded by a blue frame.

Delete

Select a measurement in a view. The selected measurement displays in red in the view, and is surrounded by a blue frame in the **Measurements** panel. Tap 🗑 .

Edit

Select a measurement in a view. The selected measurement displays in red in the view, and is surrounded by a blue frame in the **Measurements** panel. Drag and drop a point in the **Map View** (or **Station View**) to update the measurement.

Save and Export

The software automatically saves the measurement results to the project. These results will be:

- Reloaded (by tapping) when reloading the project.
- Exported with the project when exporting to the TDX format. See Export a Project.

Illustrate With a Picture

Tap 📷 to take a picture with your controller to illustrate a project (see Create a New Project) or an annotation or a precision point (see Points Tool). The preview screen displays. A framing grid is a set of lines, it helps to position and frame a picture.

- Tap ▨ **Guides Off** to activate the framing grid.
- Tap ▦ **Guide On** to deactivate the framing grid.

Tap the **Photo** button to take a picture. Optionally, tap 🔄 to rotate the picture 90° counterclockwise.

If you are satisfied with the result tap **Save**, or tap **Discard** to cancel and come back to the shooting position.

Once done, tap ✕:

- **PROJECT**: The taken picture displays as a thumbnail in the **Menu** bar and in the **Projects** page. If no picture has been attached, the first captured scan is used instead.

- **ANNOTATIONS & PRECISION POINTS**: The taken picture is attached to an annotation or a precision point in two places.

Laser Pointer

X7 & **X9** - The scanner contains visible source and invisible laser source, respectively a class 1 laser for the distance measuring function and a class 2 laser for the laser pointer function. The laser pointer is a visible laser that is emitted from the telescope. It is used to visibly indicate the point being measured.

Turn the Laser Pointer On/Off

1. Connect your scanner to a controller.

2. To enable the laser pointer:

    ○ Capture a scan.

    ○ Display the captured scan in the **Station View**, by tapping the thumbnail at the bottom left corner in the **Map View** or ❯ in the **Station View**.

3. To turn the laser pointer on, tap ✳ . The laser pointer lights on, pointing downwards (**Stop** position) inside the **Blind Zone**. A **Reticle** appears in the middle of the **Station View**.

4. To turn the laser pointer off, tap ✳ .

> **NOTE –** In the **Points** tool, the laser pointer can be used to visually locate points for precision point measurement. See Points Tool.

> **NOTE –** The laser pointer is:
> - Disabled in the ▲ **Preview Panorama** mode.
> - Enabled in the ▲ **High Quality Panorama** mode.

> **NOTE –** With the Indoor mode, the laser pointer is:
> - Enabled with an X9.
> - Disabled with an X7.

Point the Laser Spot to a Position
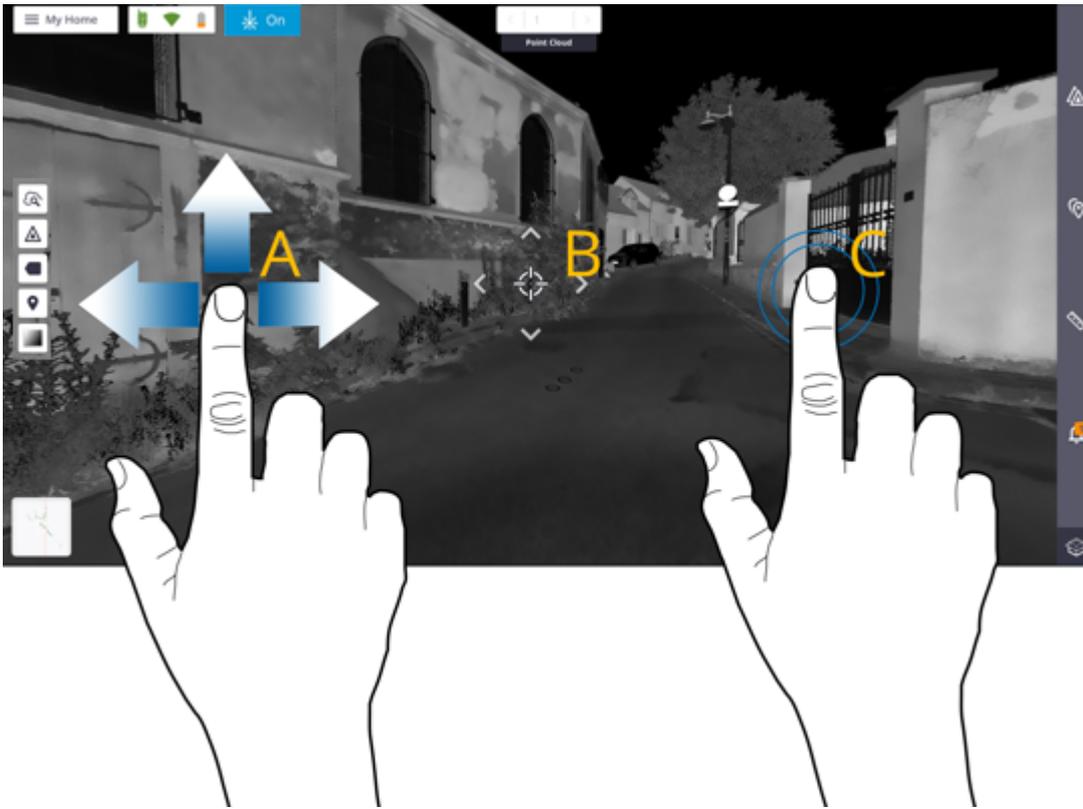
To move the laser spot over a position within the station, do one of the following in the **Station View**:

- **A** - Turn the station around its position (in any direction) to position the **Reticle** over a desired position.
- **B** - Tap in the **Reticle** and ∨, ∧, ⟩, ⟨ to move the **Reticle** with a small increment in the corresponding direction.
- **C** - Tap a position within the station to move the **Reticle** over the position.

> NOTE – The laser pointer will be turned off, if you:
>
> - Move the scanner after completing a scan. To enable the laser pointer again, capture a new scan.
> - Press the **Start Scan** button.
> - Use the **One Scan** button.

9

Refine & Georeference a Project

After registering all the stations together, you can refine the registration to get better results, and georeference the project to match the scans to real world coordinates.

Refine a Project (or Registration Set(s))

The **Refine Project** feature enhances the accuracy of the registration. It refines the position and the orientation of all the stations using the scan data. The stations need to be previously registered for this feature to work successfully.

For every station, Perspective looks at all the possible links to all the other stations, and examines their overlaps. It computes a threshold on the overlap on every station, and keeps all the links whose overlap is larger than the threshold.

In some cases, you can obtain a more accurate registration result by unlocking the level. To do this, turn the **Unlock Station Leveling During Refine** option in ⚙ **Settings** > General. This allows the refinement algorithm to slightly adjust the leveling of each leveled station to get a better fit between the scans as well as average the levelness of the project. See **Tips & Tricks** > Refine a Project.

- REFINE A PROJECT

    From the **Menu** panel, tap ☁ **Refine Project**. If required, tap **Cancel** to interrupt the process. A report displays at the end. See Display Refinement Report. ☁ **Refine Project** is displayed on the thumbnail of the project.
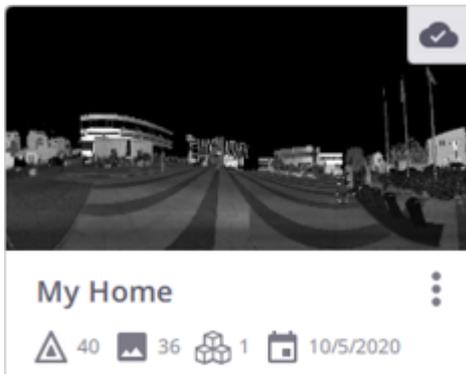
    > NOTE –
    > - The ☁ **Refine Project** will be grayed out if there is only one scan in the project.
    > - Perspective reruns the georeferencing after the refinement in case of an already georeferenced project.

- REFINE REGISTRATION SET(S)

    From the **Stations List** panel, tap the pull-down arrow and choose **REG. SET**.

    - **Refine a Registration Set:** Tap ⌄ to expand a registration set and choose ☁ **Refine** to refine the registration set.

    - **Refine a Group of Registration Sets:** Tap ☑, select a group of registration sets and tap ☁ **Refine** to refine the group.

    The **Refinement Report** displays at the end. See Display Refinement Report.

NOTE –

- The ☁ **Refine** feature is grayed-out when you are in the **Manual Registration** tool. See Manual Registration.

- Closing a report without saving deletes the report.

NOTE – When you export a refined project to the TDX format, the refinement results including the overall refined links are exported as well.

NOTE – Running a new refinement while a **Refinement Report** is still opened will close and not save the report (if you choose **Continue**).

CAUTION – Please, do not run a refinement when the battery level of the tablet is low. The process may not finish in the right way.

Georeference a Project

Georeferencing is the process of defining the absolute location and orientation of your project in the world. This is done by matching some locally observed points with some control points, whose coordinates are known in a given coordinate system.

> **NOTE –** Control points' coordinates have to be in ground coordinates with a scale factor 1.

1. Create, register and refine a project. See Refine a Project.

   > **CAUTION –** Refining a georeferenced project may break the georeferencing itself. If your project is not refined yet, the application will prompt you to do so.

2. Create at least three points (annotations, or precision points, or targets) and set them for georeferencing use. See Points Tool.

   > **TIP –** Annotations or precision points should cover the whole project, and should be measured at different elevations.

3. From the **Menu** panel, tap 🌐. The created annotations 📍 or precision points 📍 are in the **Select Point** list with the **Unmatched** status.

   > **NOTE –** Only annotations and precision points with the **Use for Georeferencing** preference selected are displayed, and the others hidden.

   - If you have no control points, do one of the following:

   ## Import Control Points

   To import a control network surveyed by traditional surveying scanners, do:

   1. Tap **Import** and import a text file in CSV format. File may have TXT, CSV, CRD, CR5, etc. extensions.
   2. In the **Import Control Points** dialog, customize the following:
      - **File Unit Type** - Select between the (X,Y,Z) coordinates system and the (N,E,El) coordinates system.
      - **Separator Type** - Select a separator between the attributes of a point.
      - **Units** - Select whether to work in Metric or imperial units. If Feet, specify whether they are US Survey Feet or International Feet.
      - **Lines to Skip** - Select the number of lines to skip. These lines can be headers, comments, or coordinates that you don't want to keep.

> **TIP –** Lines are numbered, so it is easy for you to count them.

- **Columns to skip** - Select the number of columns to skip.

3. Tap **Import**.

Create Control Points

Tap **Key In** to create a control point manually.

> **TIP – Code** refers to a description of the point to create.

- If you have less than three <u>unmatched</u> control points. The software does only shift the project to the location of the control point(s).
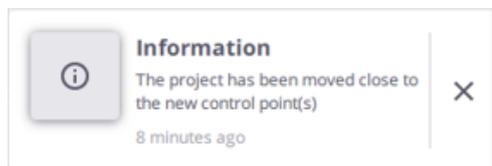
- Import or create other points.
- Or consider to match the control points manually.

- If you have less than three <u>matched</u> control points. The software prompts you to import (or create) additional control points.

- If you have three <u>unmatched</u> control points or more. The software first tries to match them automatically with the annotations or precision points (**AUTO**):
  - If succeeded (at least three pairs successfully paired), it computes the matches (see Compute the Matches).
  - If failed (less than three pairs successfully paired), it displays a red notification. Consider to check:

    - Your project, if it has been correctly registered.

    - Your points (annotations or precision points and/or control points). If required, delete or add some news.
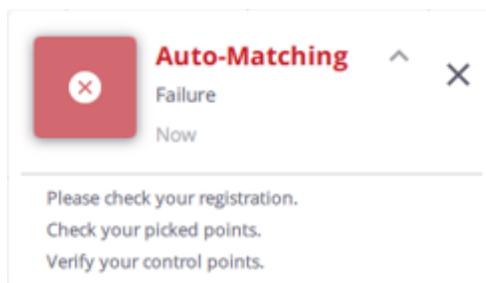
- If you have three <u>matched</u> control points or more. The software does nothing, as these points have been already paired and the errors computed. You can edit these matches (see Edit the Matches).

> **TIP –** Use ⤓ or ＋ to import or create additional control points.

> **NOTE –** Control points already imported (same name, description and coordinates) will not be imported again.

A control point displays as a pin ▲ in all views, a card in the **Control Points** panel, and a popped-up panel when selected.

In the **Control Points** panel, select a point. Its card is surrounded by a blue frame, and expands showing hidden commands. Tap:

- ◦ 👁 to hide the selected point from all views.
- ◦ 👁 to display the selected point in all views.
- ◦ ⌖ to center the selected point in the current view.
- ◦ 📖 to switch from the **Station View** display to the **Map View** (or **3D View**) display.
- ◦ 🖼 to switch from the **Map View** (or **3D View**) display to the **Station View** display.
- ◦ 🔗 to select the point to match (or unmatch).

Control Points can be removed from the project all at once (by tapping ⋮ and 🗑) or individually (by tapping ⓘ > 🗑).

Compute the Matches

After pairing successfully the control points with the annotations or precision points, the software computes the georeferencing transformation and displays:
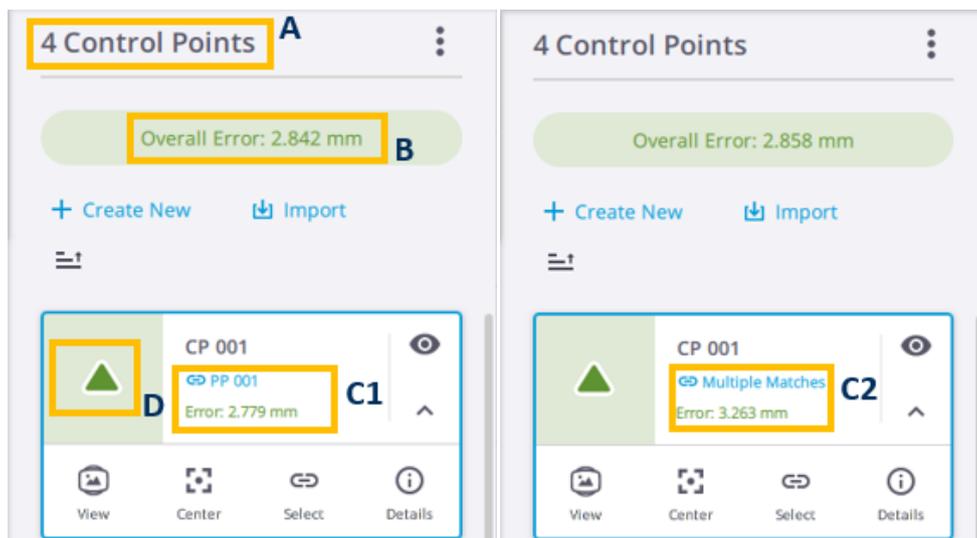
- **A** - The number of control points (matched or unmatched).

- **B** - The **Overall Error** which refers to as the average of all georeferencing errors, in green or orange.

- The **Error** in green or orange, which refers to as:

    ◦ **C1** - The distance between the control point and the annotation (or precision point), in case of **Single Match**.

    ◦ **C2** - The distance between the control point and the barycenter of all annotations (or precision points), in case of **Multiple Matches**.

- **D** - ▲ or ▲ for matched control points.

- or for a pair of matches.

> **NOTE –**
>
> - **Green** color means that the georeferencing error is under the defined **Georeference Error Tolerance**, and **Orange** color if it exceeded the defined **Georeference Error Tolerance**).
>
> - The default value for the **Georeference Error Tolerance** is 10 mm. You can change the value by tapping ⚙ **Settings** > Units or **Report** > Edit.

- A notification:

Green to notify that the **Compute Matches** has succeeded. All georeferencing errors must be under the defined **Georeference Error Tolerance** to turn the notification green.
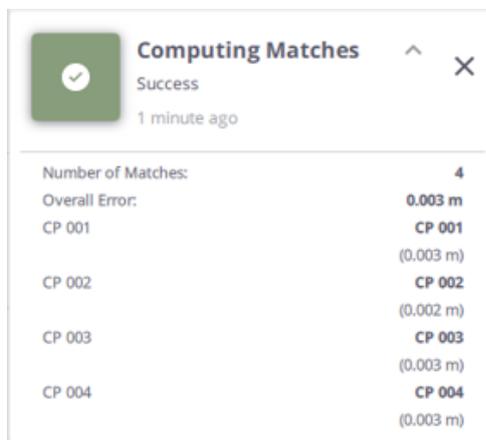
Orange to notify that the matches must be checked. One georeferencing error under the defined **Georeference Error Tolerance** is enough to turn the notification orange.
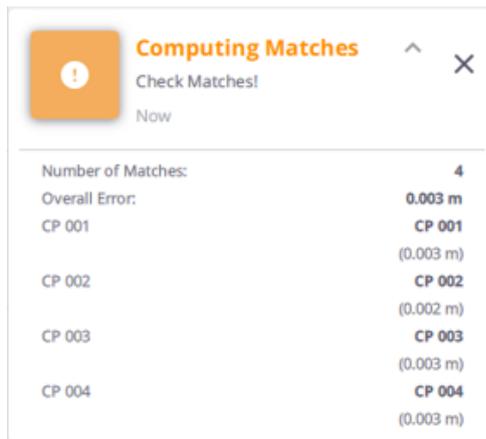
Edit the Matches

If you are unsatisfied with the matches, edit them:

Unmatch a pair of Matches

Do one of the following:

- In the toolbar, select a control point from the **Select Control Point** list, the corresponding annotation (or precision point) is automatically selected and displayed, and vice versa.

- In the **Control Points** and **Points** panels, tap 🔗 **Select** from a card.

> **NOTE –**
>
> - A control point can be also selected from the popped-up panel in the **Map View**.
> - The selected points flash in the toolbar.

Tap 🔗 **Unmatch**. The software reruns automatically the **Compute Matches** step and updates the errors.

> **NOTE –**
>
> - Deleting a matched point (control point, or annotation or precision point) is similar to unmatching the point from its matches.
>
> - Turning the **Use for Georeferencing** preference off (see Edit a Point) is similar to unmatching the point from its matches.

Unmatch all pairs

Tap ⋮ and ⊗ **All**.

Add New Points to Match

You can add additional points to the existing matches, by:

- Importing (or creating) a new control point.
- Creating an annotation (or precision point). This new point is by default set for a georeferencing use. See Add Points.
- Enabling the **Use for Georeferencing** preference of an annotation (or precision point).

The 🔗 **Auto** button flashes to notify that the number of points to consider has changed. Tap to rerun the **Auto-Match** and **Compute Matches** steps.

Match Points Manually

Select a control point and an annotation (or precision point):

- From the toolbar, by dropping down respectively the **Select Control Point** list and the **Select Point** list.

CP 001 ▼	🔗 Match	PP 001 ▼

- From the **Control Points** and **Points** panels, by tapping 🔗 **Select** from a card.

> **NOTE –**
>
> - A control point can be also selected from the popped-up panel in the **Map View**.
> - The selected points flash in the toolbar.

Tap 🔗 **Match**. The software reruns automatically the **Compute Matches** step and updates the errors.

> **TIP –** To match a matched control point with several annotations (or precisions) (**Multiple Matches**), tap 🔗 from a card to select the control point, and select the annotations (or precision points) one-by-one from the toolbar.

Change the Target Height Value

To modify the **Target Height** value of a precision point, see Edit a Point. If this point is:

- Already Matched: The software recomputes the errors based on this change, and the 🔗 **Auto** button flashes to prompt you to rerun the **Auto-Match** and **Compute Matches** steps.

- Unmatched: Only the 🔗 **Auto** button flashes to prompt you to rerun the **Auto-Match** and **Compute Matches** steps.

> **NOTE –** A precision point which has not been set for the georeferencing use is hidden in all views. In the **Points** panel, 👁, ⬚ and 🔗 are all grayed-out. When the 🖼 **Preview Panorama** mode is on, all precision points are hidden.

Apply the Georeferencing

Once all matches are computed, tap **Apply** to apply the transformation to the project. 🌐 is displayed on the thumbnail of the project.
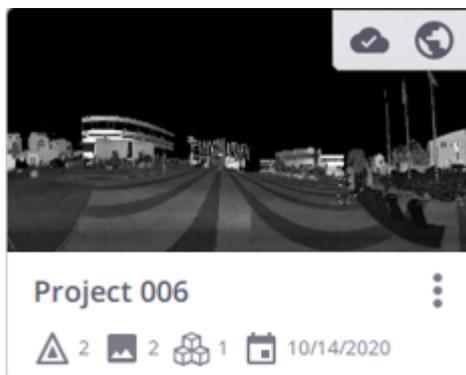
Or tap **Close** and choose **Apply** to apply the transformation to the project, or **Close** to not apply the transformation to the project (the matches and the transformations (rotation and translation) from the last **Apply** are restored). The next time you reopen the **Georeferencing** tool:

- Control points:
    - Added points remain added.
    - Deleted points remain deleted. The matches associated with the deleted points are not restored.

- Annotations or precision points:

    ○ Added points remain added.

    ○ Deleted points remain deleted. The matches associated with the deleted points are not restored.

    ○ Unchecked **Use For Georeferencing** preference remains unchecked. The matches associated with the point are not restored.

    ○ Modified **Target Height** value remains modified.

Or tap **Cancel** to abort the operation.

To export the georeferencing results in a report, run the refine report. See Refine a Project.

> **NOTE –** If a report has been generated before starting the **Georeferencing** tool, you DO NOT NEED to re-run the refinement. You simply open the report again. It will have the newest georeferencing changes applied.

10

Finalize & Export

Finalize your project for hand-off. Refine and georeference it again to show the results in a report, and for the unprocessed images (scan colorization not yet done, or high quality panoramas not yet created), process them all in batch mode. Once done, export the project to industry standard format files.

Display Refinement Report

After refining the registration of all the stations, and georeferencing your project, tap ☰ **Menu** > 📊 **Display Refinement Report** to run a report.

> **NOTE –** The report is displayed automatically when a registration set (not the whole project) is refined.

Report

The **Refinement Report** displays:

- In the **Project Summary** field:
  If all stations have been successfully registered together in one registration set: The number of stations in the project, the number of registration sets (One) and the average value for RMS Error, Overlap and Consistency.

Reg. Sets	Stations
1	38

Average Error	Average Overlap	Average Consistency
4.0 mm	41 %	87 %
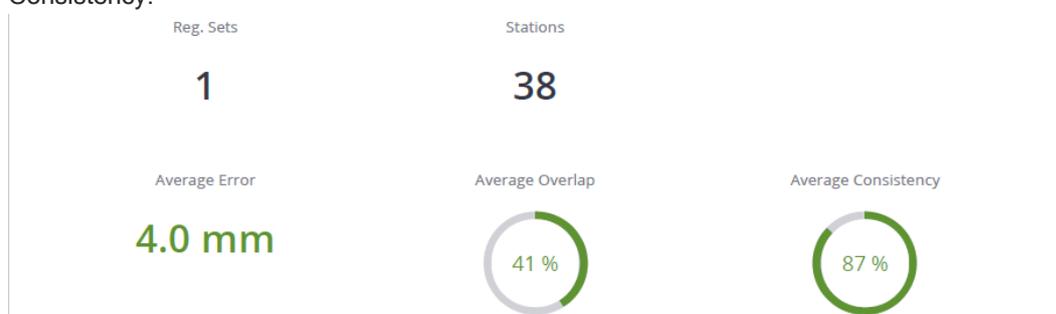
  If at least one station remains un-registered: No average value for RMS Error, Overlap and Consistency is displayed.

Reg. Sets	Stations	Unregistered Station(s)
1	38	1

  Error(s)
  - **You have 1 unregistered station(s)!**
    - Consider manually registering them to complete your project.
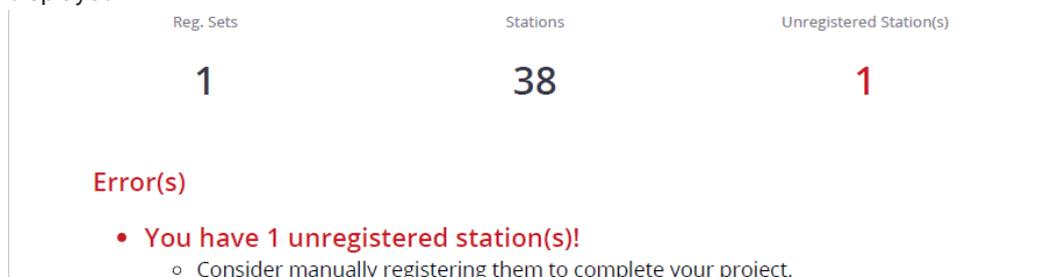
- In the **Reg. Set(s) Selection Summary)** field, when refining:
  A registration set: The number of stations selected in the registration set, the number of registration set(One) and the average value for RMS Error, Overlap and Consistency.
  A set of registration sets: The number of stations selected in the registration sets, and the number of registration sets.

- In the **Refinement Summary** field: the unregistered stations (if existed), the registered stations, the registration information per registration set [**A**], and per station [**B**].

Reg. Set 3	4 Stations		0.8 mm Avg. Error	66 % Avg. Overlap	100 % Avg. Consistency	Reference Station: 1
Station Name	**Links**	**Avg. Error (mm)**		**Avg. Overlap (%)**	**Avg. Consistency (%)**	
1	3	0.9 mm		37 %	100 %	
2	3	0.8 mm		77 %	100 %	
3	3	0.7 mm		75 %	100 %	
4	3	0.7 mm		75 %	100 %	

- In the **Refinement Details** field: the registered stations and the registration information per registration set [**A**], and per station (station registered to other stations [**B**] and station registered to one station [**C**].

Reg. Set 3	4 Stations	0.8 mm Avg. Error	66 % Avg. Overlap	100 % Avg. Consistency	Reference Station: 1
1	3 Links	0.9 mm Avg. Error	37 % Avg. Overlap	100 % Avg. Consistency	
Linked Station	**Error (mm)**	**Overlap (%)**	**Consistency (%)**	**Distance (ft)**	
2	1.1 mm	41 %	100 %	0.012 ft	
3	0.8 mm	34 %	100 %	0.010 ft	
4	0.9 mm	35 %	100 %	0.007 ft	
2	3 Links	0.8 mm Avg. Error	77 % Avg. Overlap	100 % Avg. Consistency	
Linked Station	**Error (mm)**	**Overlap (%)**	**Consistency (%)**	**Distance (ft)**	
1	1.1 mm	41 %	100 %	0.012 ft	
3	0.8 mm	95 %	100 %	0.007 ft	
4	0.6 mm	95 %	100 %	0.006 ft	

- In the **Georeference** field: the number of control points matched with annotations or precision points [**A**], the distance between points in a pair [**B**], the average distance of all matched pairs [**C**].

4 Control Points Matched					**C** 2.8 mm Avg. Error
Control Point	**Match With**	**Error (mm)**	**Delta N (mm)**	**Delta E (mm)**	**Delta El (mm)**
CP 001	PP 001	2.8 mm	-1.3 mm	-2.4 mm	0.6 mm
CP 002	PP 002	2.0 mm	1.2 mm	1.4 mm	0.8 mm
CP 003	PP 003	3.3 mm	-2.4 mm	-1.1 mm	-1.9 mm
CP 004	PP 004	3.3 mm	2.5 mm	2.1 mm	0.5 mm

Green color means that the distance in a pair or the average distance of all pairs is under the defined **Georeference Error Tolerance**.

Orange color means that the distance in a pair or the average distance of pairs exceeds the defined **Georeference Error Tolerance**.

Change the Threshold value for the **Georeference Error Tolerance**. See Edit.

> **NOTE –** There is no **Georeference** field in the report when refining a registration set.

Registration Information

- **STATISTICS**: Statistics consist of:

  Consistency (%) giving an idea of how reliable a pair (of registered stations) is. It is expressed in percentage.

  Distance referring to the distance between two registered stations (from station position to station position).

  Link referring to the registration link(s) from a registered station.

  Overlap (%) referring to the amount of common points per pair (of registered stations) in percentage. The percentage in a pair (of registered stations) is the same from one direction to the other (e.g. from Station_A to Station_B or from Station_B to Station_A).

  Reference Station referring to a station whose position remains unchanged and the other stations will be moved to register to it.

  RMS Error referring to the root mean square of the point-to-point distances on the overlapping areas. It is computed from the distances between individual points in the first scan to their corresponding scan point in the second scan. The error is symmetrical; it has the same value from Station_A to Station_B as from Station_B to Station_A.

  > **TIP –** The **RMS Error** and **Distance** units can be changed in ⚙ **Settings** > Units, page 24.

- **COLORS**:

29	3 Links	1.0 mm Avg. Error	64 % Avg. Overlap	100 % Avg. Consistency
Linked Station	**Error (mm)**	**Overlap (%)**	**Consistency (%)**	**Distance (m)**
27	1.1 mm	44 %	100 %	20.477 m
28	1.0 mm	72 %	100 %	11.867 m
30	1.0 mm	77 %	100 %	13.942 m

30	3 Links	1.9 mm Avg. Error	57 % Avg. Overlap	100 % Avg. Consistency
Linked Station	**Error (mm)**	**Overlap (%)**	**Consistency (%)**	**Distance (m)**
27	3.0 mm	40 %	100 %	32.917 m
28	1.5 mm	53 %	100 %	19.612 m
29	1.0 mm	77 %	100 %	13.942 m

A **Link** displays orange in three cases:

- If the **RMS Error** is larger than the defined Threshold. Change the Threshold value (see Edit).

○ If the **Overlap (%)** is considered poor.

○ If the **Consistency (%)** is considered poor. This may mean that some objects have moved or that the two scans are not supposed to match.

What does consistency mean on a link? The consistency is a ratio based on the number of points that match and the number of points that are 'obstacles', indeed like persons or objects that moved between the two scans. This is defined for a connection between two scans.

A **Station** displays orange if one of the links / connections from the station is orange.

What does consistency mean on a station? The application computes an average value for RMS error, overlap and consistency over all the links connecting this scan/station.

Edit

With the report opened, tap **Edit**. From the opened **Edit Report Details** panel, add the information about your company (Logo, Name and Website), the information about you (name and title), and additional images. If required:

- Change the Threshold value for the **RMS Error**. It refers to the root mean square of the point-to-point distances on the overlapping areas.
- Or reset to the **RMS Error** value to the default value (6 mm / 0.02 ft).
- Change the Threshold value for the **Georeference Error Tolerance**.
- Or reset to the **Georeference Error Tolerance** value to the default value (10 mm).

Tap **Save**.

Save

Save the report in a **PDF** or **HTML** format file.

Finalize a Project

To finalize a project, refine the registration on the whole project, rerun the georeferencing, colorize uncolorized scans, and create missing **High Quality Panoramas**. Optionally, export the project.

From the **Menu** panel, tap [⬆] **Finalize & Export**.

- **REFINE PROJECT**: Check the option to enhance the accuracy of the registration. It will refine the position and orientation of all the stations using the scan data.

- **GEOREFERENCE**: Check the option to recompute the matches between the control points and the annotations (or precision points) and to reapply the georeferencing to the project.

> **NOTE –**
>
> - The **Georeferencing** must be rerun after a **Refine Project** as station positions and orientations (by extension, positions of involved points) will have changed.
>
> - The **Georeferencing** option is grayed-out if the project has not been georeferenced.

- **COLORIZE POINT CLOUDS**: Check the option to colorize a set of scans in batch mode.

> **TIP –** Select the **True Color** rendering from the ◆ **Options** in the **Map View** to view the colorization applied to the scan data.

> **CAUTION –** A scan can be colorized only once. After colorizing, the **Colorize Point Clouds** option becomes dimmed in the **Finalize & Export** dialog, and appears again if you add other scans to the project.

- **CREATE HIGH QUALITY PANORAMA**: Check the option to automatically colorize point clouds and create all panoramas in batch mode.

> **CAUTION –** A **High Quality Panorama** can be created only once. After creating, the **Create High quality Panorama** option disappears from the **Finalize & Export** dialog, and appears again if you add other scans to the project.

- **EXPORT PROJECT**: Check the option to export the project to industry standard file formats (see Export a Project).

Export a Project

To export the current project to a file format, tap ≡ > [↑] to open the **Finalize & Export Project** dialog. Check the **Export Project** option, tap ▼ to choose the appropriate format to export to and tap ••• to define the export path. Projects are exported in a folder named according to the project name followed by the export format.

To cancel an export in progress, tap **Cancel**.

> **NOTE –** Perspective will display a warning if the export path contains any forbidden characters (<>V?:"|) or an emoticon.

> **TIP –** In the **Stations List** panel, use [☑] > [✔] > [↑] to export the current project (see Export Stations).

- **TDX**: TDX is a Trimble Data eXchange file format, commonly used in some Trimble software applications like TBC (Trimble Business Center) or RealWorks. Perspective exports the information listed below:
  - Stations with registration sets,
  - Overall refined links, referring to the results of refining the alignment and transformation of the datasets to improve their accuracy after a registration. See Refine a Project (or Registration Set(s)),
  - Created panorama(s),
  - Measured points, and distances,
  - Leveling information,
  - Registration transformation information,
  - Created labels,
  - Georeferenced matches,
  - Measurements.

  As a result, the following is created:
  - A project file named according to the project name with the TDX extension.
  - A TDF (Trimble Data Files) folder with a set of TZF format files (one per scan), and a set of TCF format files (one per X7/X9 scan) or a set of TOI format files (one per X12 scan) if the images have been acquired, and a set of TPF format files (one per station)) if a panorama has been created from the captured images (see Create Panoramas).

- **TZF**: This format is a Trimble scan file in a zipped format. Perspective exports the current project as a folder with:
  - One TZF format file per scan.
  - One TCF format file per scan if the images have been captured (see Capture Images).

  X12 - TOI format files will be exported as TOI format files.

- **E57**: This format is a file format specified by the ASTM (American Society for Testing and Materials), an international standards organization. The E57 format supports two types of data: Gridded Data and Non-Gridded Data.

    ○ Gridded data is data which is aligned in regular arrays. Perspective exports the current project as a set of E57 format files (gridded), one per scan.

    ○ Non-gridded data is an irregular grid point set. Perspective exports the current project as a E57 format file (non-gridded).

- **PTX**: This format is an ASCII based scan file format. The software exports the current project as a set of PTX format files, one per scan.

- **LAS - SINGLE, NON-GRIDDED**: This format is a public file format for interchanging 3-dimensional point cloud data between data users. It is binary-based and has several versions: 1.0, 1.1, 1.2, 1.3 and 1.4. Perspective exports the current project as one LAS 1.2 (or 1.4) format file.

    > **CAUTION –** Exporting to LAS 1.2 format has a limitation of 4.2 billion points for a single file, due to the 32-bit integer limit for point indices in the LAS 1.2 specification. If you need to handle datasets larger than this, consider exporting the data to LAS 1.4 format, which uses 64-bit integers instead, allowing for up to 18 quintillion points. For both formats, make sure you have sufficient space on your export path.

- **POD - SINGLE, NON-GRIDDED**: The POD (Point Database) file format is a Bentley Pointools' native point cloud format. The software exports the current project as one POD format file. Points, color, intensity and normal (if available) information are exported.

    > **CAUTION –** Exporting to the POD format may take several minutes per scan.

- **RCP**: This format file is a project file for Recap from AutoDesk. The software exports the current project as one RCP format file and a folder named following the project name with the "Support" extension. For each scan, a scan file with the RCS extension is created.

    > **CAUTION –** Exporting to the RCP format may take several minutes per scan.

- **HIGH-QUALITY PANORAMA 360° IMAGES**: When exporting a project to the above formats, for each full dome scan with a high quality panorama, the software exports:

    ○ The high quality panorama as a 360° image in JPEG format in a specific folder (HQ Panorama Images).

    ○ The registration information (location and orientation) of the high quality panorama in a CSV format file with the following information:

    - Name of the JPG station panoramic images.

    - Location expressed with X,Y,Z coordinates in meters (International System of Unit).

    - Orientation using the center of the image as reference and expressed as a quaternion (qx, qy, qz, qw).

NOTE – For one of the following exports (RCP, PTX, and Gridded E57), the software will not apply the tilt compensation to the registration frame but directly to the point coordinates. This means a leveled station has an up direction equal to (0, 0, 1).

Export Stations

Stations are exported in a folder named according to the project name followed by the export format. As for the export of a project, if the station has a high quality panorama, Perspective exports the high quality panorama as a 360° image in JPEG format in a specific folder (HQ Panorama Images), and the registration information (location and orientation) of the high quality panorama in a CSV format file with the following information:

- Name of the JPG station panoramic images.

- Location expressed with X,Y,Z coordinates in meters (International System of Unit).

- Orientation using the center of the image as reference and expressed as a quaternion (qx, qy, qz, qw).

Export a Set of Stations

1. Tap ⚠ to open the **Stations List** panel.

2. (Optional), filter the stations by name(s) or by label(s):

   a. Tap 🔍 to open the **Search** field in the **Stations List** panel.

   b. Filter the stations by name.

      1. Type the station names separated by commas (e.g. 1, 3, 8) and (or) station ranges separated counting from the start of the station or the selection (e.g. 5-8).

         > **NOTE –** To make the station names easy to read, you can put a space before and after a comma.

      2. Type 🔍 (or **Enter**).

         > **NOTE –** Filtered stations remain displayed, and you can add new ones to filter.

      > **TIP –** Tap ⚠ to switch to the label filtering and to clear the filtering.

   c. Or filter the stations by label(s):

      1. Enter a label name and type **Enter**.

      2. Or select a label from the drop-down list (if any).

      3. Or select a label from the list of labels (if any) for a station.

> **TIP –** Tap 🏷 to switch to the station filtering and to clear the filtering.

d. Tap ✖ to close the **Search** field.

> **NOTE –** You delete a label filtering by removing it.
>
> 🔍 2 Stations   ✕
>
> L1 ✖

3. Select a set of stations:

   a. Tap ☑ to open the **Stations Selection** tool. If no filter has been applied, all stations in the project are displayed. If a filter has been applied, only the filtered stations (either by name(s) or by label(s)) are displayed. In the **Reg. Set**. display mode, a **Reg. Set**. with no filtered station(s) is not displayed.

      - Tap a station card to select the station. Tap again the station card to deselect the station.

      - Tap ☑ to select all the filtered stations. Tap ☑ again to deselect the selected stations.

   > **TIP –** You can select a registration set and export all the stations of the set.
   >
   > 🔍 3 Reg. Sets   ✕
   >
   > ⬆   Reg. Set ▼   ☑
   >
   > ☑ **Reg. Set 4**   👁
   >   15 Stations   ⌄
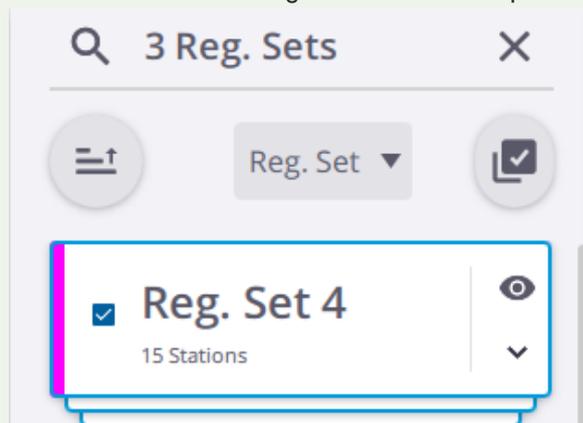
   b. (In option), tap 🗑 to delete the selected station(s).

> **NOTE –** Selecting all stations in the project to export is similar to exporting the whole project (see Export a Project). The project has to have at least two stations.

4. Tap ⬆ and:

   - Tap ▼ to choose the appropriate format to export to. See Export a Project for the available formats.

   - Tap ••• to choose the export path.

- If some stations have been selected, choose to **Colorize Point Clouds** and **Create High Quality Panorama**.

- If all stations of the project have been selected, in addition to the upper options, choose to **Refine Project** and **Georeference**. The project has to have at least two stations.

5. Tap ⊗ to close the **Stations Selection** tool.

Export a Single Station

1. Do one of the following:

   - Tap ▲ in the **Map View** to display the pop-up menu.

   - Tap ◭ to open the **Stations List** panel:

     ○ Expand a station card and tap ⓘ **Details**.

     ○ Or tap ☑ to open the **Stations Selection** tool, and select a station.

2. Tap ⬆ and:

   a. Tap ▼ to choose the appropriate format to export to. See Export a Project for the available formats.

   b. Tap ••• to choose the export path.

   c. Choose to **Colorize Point Clouds** and **Create High Quality Panorama**.

3. Tap **Export**.

11

Resources

In this chapter, you can find additional resources like FAQs, Tips and tricks and Contact.

FAQs

- **UTF-8 CHARACTERS IN THE DATABASE PATH**: If there are some UTF-8 characters in the user name (which means in the path to the application database), a new repository will be created and linked to the path:

  - Default Path With UTF-8 Characters: "C:\users\ʁҤӱґыÖ\AppData\Local\Trimble Perspective DB".

  - Created Path Linked to the Default Path: "C:\TrimblePerspectiveLinks\xxxxxxxx" with xxxxxxxx an integer hash key of c:\users\ʁҤӱґыÖ\AppData\Local\Trimble Perspective DB.

- **X7** & **X9** - **AUTO-REGISTRATION SKIPPED**: The Auto-Registration of the current scan is skipped in case the Self-Leveling is turned off.

- **X7** & **X9** - **SCANNER ERROR - INVALID STATION**: The software performs a Tilt measurement before and at the end of a scan and compares the results. The resulting station is flagged as invalid and is not saved if the scanner is within:

  - A range of +10° and -10° from either side of its vertical axis, the gap is over 1.5 milliradians.

  - The following ranges, from +10° to +45° and from -45° to -10° from either side of its vertical axis and the gap is over 5 milliradians.
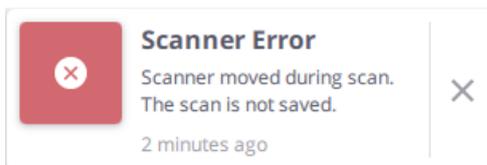

- **X7** & **X9** - **CONNECTION LOST WHILE SCANNING**: An acquisition of scans and images in progress does not terminate even if the controller has been disconnected from the scanner for one of the following reasons: Wi-Fi signal lost, or USB 2.0 connection issue, or the application closed by accident, etc.

- **NUMBER OF SCANS PER PROJECT**: With a Trimble T10 tablet, there is no limit to the number of captured scans per project, and the project refinement works up to 160 scans.

- **WHEN A PROJECT IS LEVELED OR UNLEVELED?**: A project is considered as:

  - "Leveled" if only one of its scans is leveled.

  - "Unleveled" if all of its scans are unleveled.

- **AUTO-REGISTRATION SKIPPED**: The Auto-Registration is also skipped when the next scan position is on the previous one.

Tips and Tricks

Below are listed some tips and tricks that can help you in your daily duties.

- **X7** & **X9** - **SCANNER ERROR - CALIBRATION ERROR**: A calibration error message may appear during the Initialization step before scanning.

  Scanner Error
  An error occurred during calibration
  12 minutes ago
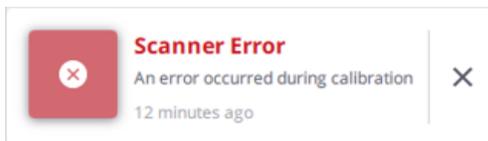
  This can happen when the scanner has not been used for a long time, and dust has settled over the laser aperture area [**A**] and the auto-calibration system [**B**]. Remove dust carefully with a soft cloth.
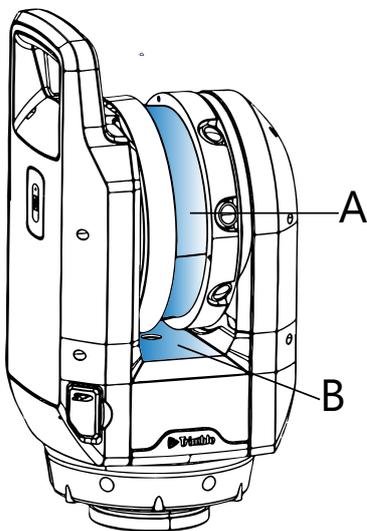
- **X7** & **X9** - **ONE SCAN BUTTON SETTINGS**: The settings for the scan Push button feature are the last used ones, or the default ones (if using the scanner for the first time). Any change in the settings in the application is immediately taken into account by the scanner for the next scan.

- **DATA ACQUISITION CONTINUES EVEN IF THE CONNECTION IS LOST:**

  If the connection to the scanner has been interrupted (Wi-Fi signal lost, or USB connection issue, or the application closes, etc.) when the scanner is collecting the data.

  The scanner continues collecting the data till the end.

  The captured scan data, first saved on the SD card in the scanner, is automatically loaded to the application database if:

  - The controller has been reconnected to the same scanner.

  - The scanner has been turned first off and then on, and reconnected to the same scanner.

  The captured scan data is not loaded to the application database if:

- The controller has been connected to a different scanner.

- A new project has been created or a previous project loaded in Trimble Perspective, and the controller reconnected to the same scanner.

- **TRANSFER DATA**: To transfer the data from the tablet to an office computer, use the SD card provided with the scanner. Use an external hard drive (Read/Write Speed 500MBs, Support UASP & USB3.0) to store and transfer data.

- **RCP FILE FORMAT**: Exporting to the RCP format may take several minutes per scan. To avoid this, do:

  - Export to an E57 format file from Trimble Perspective.

  - Import the E57 format file into ReCap and generate a RCP format file.

- **ROTATE THE MOVING SCAN IN THE MANUAL REGISTRATION**: To fix the wrong IMU orientation, the software is using the same procedure as for the Auto Registration which means moving the scan and a Fast Refine is performed

- **MOVE THE MOVING SCAN IN THE MANUAL REGISTRATION**: When you move the Moving Scan in 2D as close as possible to the Reference Scan to register them manually, the software will perform a Full Refine.

- **SPECIFIC REGISTRATION WORKFLOW**: When the first scan is unleveled and the second scan is leveled, the software will swap the registration order, meaning that the unleveled scan (Moving Scan) will be registered to the leveled scan (Reference Scan).

- **GEOREFERENCE A PROJECT**: Only the Auto matching functionality needs three pairs of annotations (or precision points) and control points. Manually you can set up matches with no restrictions.

- **REFINE A PROJECT**: In some cases, you can obtain a more accurate refine result by enabling the Unlock Station Leveling During Refine option (see ⚙ **Settings** > General):

  - Use the option during smaller projects (e.g. around or in a building).

  - Do not use the option on larger projects (e.g. around a bridge over a highway), long linear or heavily sloped projects.

- **DATA COLLECTED WITHOUT THE CONTROLLER**: The data (collected by using the scan Push button for the X7 & X9 and the on-board application for the X12) is stored:

  - Only in the memory card, if you have not previously connected the controller to the scanner and performed at least one scan.

    Use [⬇] to import the data in Perspective (see Import a Scan).

  - In the memory card and in the application database, if you have previously connected the controller to the scanner and performed at least one scan.

    Use 🔄 to synchronize the data in the memory card with the data in the application database at the next connection to the scanner (see Synchronize Data).

Glossary

- **X7** & **X9** - **AUTO-ANGULAR CALIBRATION**: The Auto-Angular Calibration is performed by the scanner. It applies a correction to the collimation error, i.e., the deviation of the Horizontal Axis (HA), or Vertical Axis (VA), or Sight Axis (SA).

- **X7** & **X9** - **AUTO-DISTANCE CALIBRATION**: The Auto-Distance Calibration is performed by the scanner. It applies a distance correction in the albedo measurement and the distance measurement.

- **FIRST SCAN AUTOMATIC ORIENTATION**: This step is always applied to the first captured scan. It consists in finding the correct orientation of the captured data. At the end of the step, a notification pops up and summarizes the state of the step (succeeded (Green) or failed (Red)).

- **AUTOMATIC REGISTRATION**: The Automatic Registration is always enabled and works with pairwise scans or pairwise registration sets. When the Automatic registration is launched, it computes a transformation to fit the current scan with the previous one (default mode) (A), or with a chosen one (B) as perfect as it can. It can also compute no transformation (C).
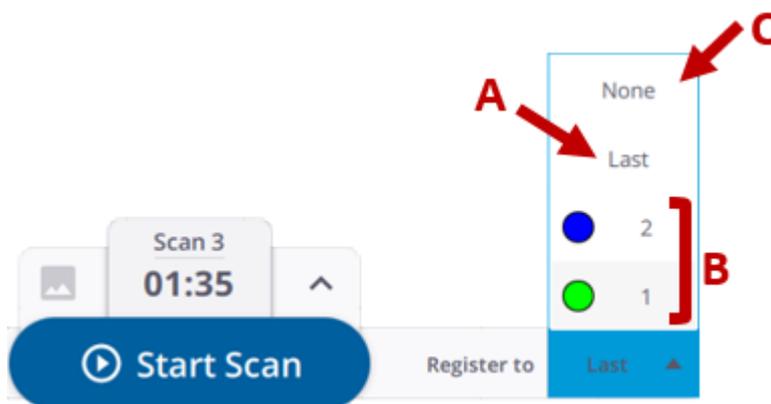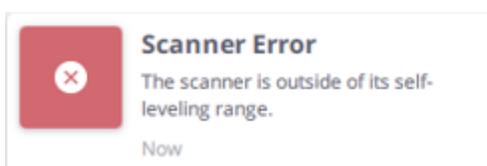

After each Automatic registration, some statistics are computed. The computed statistics and the resulting notification are here to help you inspect the transformation but do not replace a human control.


- **CONSISTENCY (%):** This gives an idea of how reliable a pair (of registered stations) is. It is expressed in percentage.

- **DISTANCE**: This refers to the distance between two registered stations (from station position to station position).

- `X7` - **FIELD CALIBRATION**: The Field Calibration refers to both the Auto-Angular Calibration and the Auto-Distance Calibration.

- **HDR (High Dynamic Range)**: When the mode is On, the scanner captures two additional images (one darker and one brighter) when it captures an image, and mashes them together to create a single image with more color and detail in both the bright and dark areas.

- **JSON**: It's a lightweight file in JavaScript Object Notation format that enables interchanging data.

- `X7` - **DIAGNOSTIC**: This feature consists in running a series of tests in the scanner. Tests are subdivided as follows:

  - Information Tests: Firmware, temperature value, etc.

  - Sub-part Detection Tests: Presence of memory card, IMU, etc.

  - Advanced Tests: Deflection, Auto-calibration distance, Auto-distance calibration, etc.

  Results are not displayed with values but with colors: Green (Pass) and Red (Fail).

- **LINK**: The Link refers to the registration link(s) from a registered station.

- **OVERLAP (%)**: The Overlap (%) refers to the amount of common points per pair (of registered stations) in percentage. The percentage in a pair (of registered stations) is the same from one direction to the other (e.g. from Station_A to Station_B or from Station_B to Station_A).

- **REGISTRATION**: A Registration consists in applying a transformation to the current scan so that it fits as much as possible to the previous station or to a chosen station, whatever the method (automatic or manual). The goal is to have your project completely registered from the first scan to the last one, meaning that all stations reside in a unique registration set.

- **RMS ERROR**: The RMS Error refers to the root mean square of the point-to-point distances on the overlapping areas. It is computed from the distances between individual points in the first scan to their corresponding scan point in the second scan. The error is symmetrical; it has the same value from Station_A to Station_B as from Station_B to Station_A.

- `X7` - **SELF-LEVELING**: This option is by default on. It consists in measuring the horizontality and verticality of the scanner. If the scanner is within a range of +10° and -10° from either side of its vertical axis, the captured stations are Leveled. If the scanner is within the following ranges, from +10° to +45° and from -10° to -45°, from either side of its vertical axis, the captured stations are Not leveled. If the scanner is out of the operating ranges, i.e., greater to +45° and -45° from either side of its vertical axis, the software displays an error and then prevents you from collecting the data.

Scanner Error

The scanner is outside of its self-leveling range.

Now

- **WHITE BALANCE**: This is a process that a camera uses to remove color casts produced by the different color temperatures, so that white objects appear white in the pictures.

In the Auto mode, the white balance correction is disabled in the scanner. The images are captured with no correction. The correction is applied to the images in the software once they are downloaded (a notification pops up once the correction is applied).
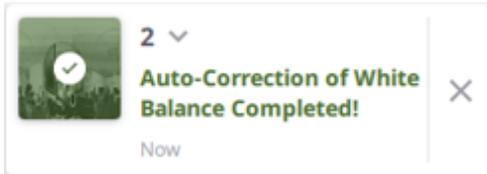
With the other modes, the images are directly corrected once captured by the scanner (no notification popped-up by the software).
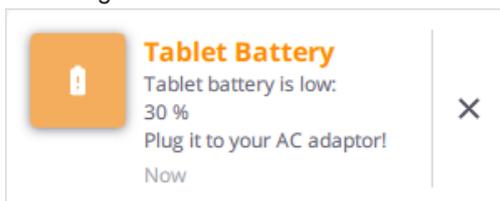
Battery States and Notifications

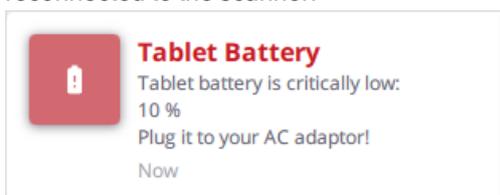Below are the states and notifications for the scanner battery and the controller battery.

Controller Battery

When the charge level of the battery in the controller reaches one of the two thresholds:

- **30 %** is considered low. A warning notification (in orange) pops up. You can still work with the scanner for collecting data.

  Tablet Battery
  Tablet battery is low:
  30 %
  Plug it to your AC adaptor!
  Now

- **10 %** is considered critical. A critical notification (in red) first pops up. The software will display a warning message when tapping the **Start Scan** button. The scanner will continue acquiring data till the end and the scan data should be retrieved later once the battery will be sufficiently charged and the controller reconnected to the scanner.

  Tablet Battery
  Tablet battery is critically low:
  10 %
  Plug it to your AC adaptor!
  Now

> **NOTE –** Trimble Perspective monitors the battery in the controller every 10 minutes if its charge level is above 30%, every 5 minutes if it is between 30% and 10% and every minute if it is below 10%.

Scanner Battery

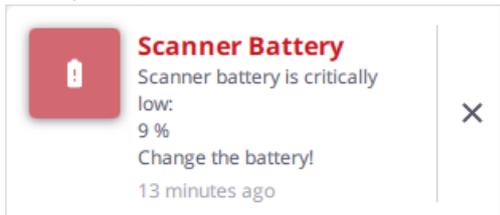When the charge level of the battery in the scanner reaches one of the three thresholds:

- **25 %** is considered low. A warning notification (in orange) pops up. You can still work with the scanner for collecting data.

  Scanner Battery
  Scanner battery is low:
  18 %
  17 minutes ago
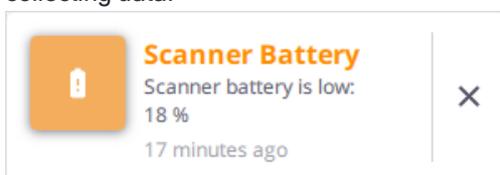
- **15 %** is considered low. A second warning notification (in orange) pops up. You can still work with the scanner for collecting data.

  Scanner Battery
  Scanner battery is low:
  12 %
  Now
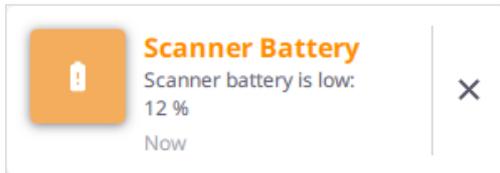
- **10 %** is considered critical. A critical notification (in red) pops up. The application displays an error message when you tap:

  Scanner Battery
  Scanner battery is critically low:
  9 %
  Change the battery!
  13 minutes ago

  - The **Start Scan** button, and prevents you from scanning. This avoids getting corrupted (or incomplete) scan data.

  - The **Scan Point** button.

X7 & **X9** - The scanner beeps four times and lights up all five LEDs on its base in red.

X12 - The charge level of the battery displayed in the application and on the top status bar of the on-board application is the charge level of the right and left batteries of the scanner.

NOTE – To check the charge level of the left and right batteries, tap ⌄ to display the **System Information** panel. Refer to the Trimble X12 3D Scanner user guide for more information.

CAUTION – Perspective prevents you from scanning but the on-board application does not.
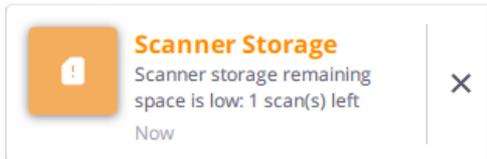
NOTE –

- The charge level of the battery can be checked by tapping the **Scanner** icon next to the **Menu** icon.

- It is highly recommended to change the battery when it becomes older. Battery usage time may drop significantly fast. Some longer scans or image acquisition may not finish on older batteries.

Memory Card States and Notifications

When the space left on the memory card in the scanner reaches the following threshold:

- **850 MB** is considered low. A warning notification (in orange) pops up. You can still work with the scanner for collecting the data.

  Scanner Storage
  Scanner storage remaining space is low: 1 scan(s) left
  Now

- Not enough space to save the current scan, a critical notification (in red) first pops up. Perspective prevents you from collecting the data by displaying a warning message (if you tap the **Start Scan** button).

  Scanner Storage
  Scanner storage is full. Please clear up some space!
  3 minutes ago
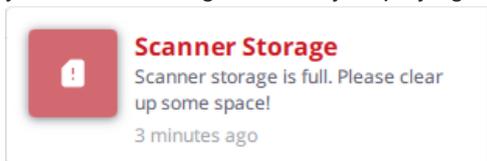
> **NOTE –** Perspective displays a critical notification (in red) and the LEDs on the scanner light red if the SD card is write-protected or locked.
>
> **Scanner Storage**
> SD Card is locked
> Now

Scanner License Notifications

You can assign a perpetual license (a permanent license for an X9 configuration), or a subscription license (a term-based license for an X9 configuration), or both to a connected X9 scanner.

To view the license information assigned to the connected X9 scanner, tap ☰ **Menu** > ⓘ **About** to open the box.
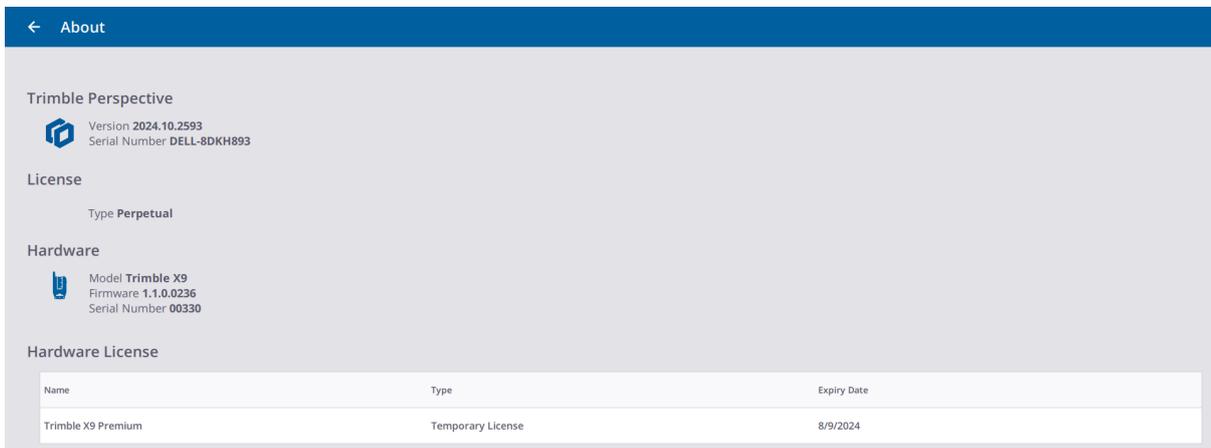
> **NOTE –** Refer to the Trimble X9 Core / Premium User Guide for more information.

Subscription License

When you use a subscription license and it expires without renewal or updating on the specific renewal date, it enters a five-day grace period, plus a two-day emergency period after those five days. Once both periods have expired, the instrument can no longer operate until you renew your license or purchase a new one. Perspective notifies you when your subscription license:
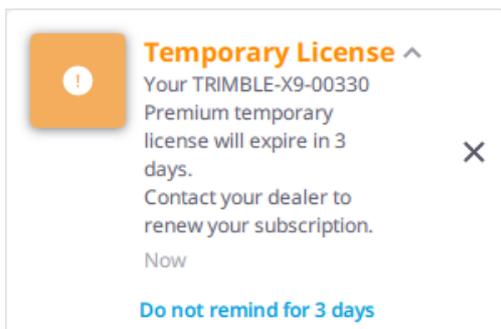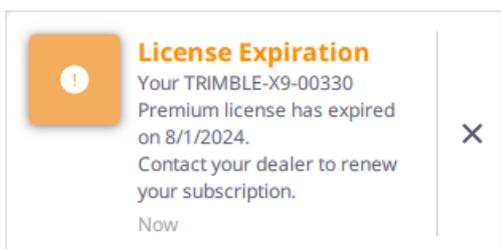
- Expires soon (in less than 30 days):

- Enters the 5-day grace period. It happens after the license expires.
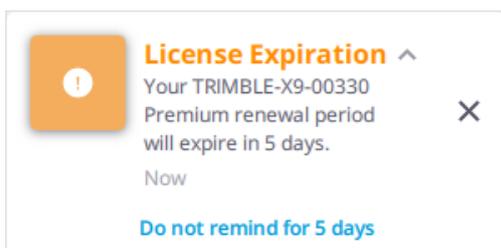
- Enters the 2-day emergency period. You will be prompted to activate this one-time period.

- Has expired:

Perpetual License

A perpetual license is permanent with no expiration date. No renewals are required.

Subscription License and Perpetual License

You can purchase two different licenses (one perpetual and one subscription) and assign them to the same instrument. The subscription license will take precedence over the perpetual license until it expires. The perpetual license will automatically become active upon expiration of the subscription license.

Only a 5-day grace period is offered after the subscription license ends when combining the perpetual license with the subscription license.

Trimble Solution Improvement Program

We invite you to join the Trimble Solution Improvement Program to help us improve the quality, reliability, and performance of this software.

If you accept by activating the option in ⚙ **Settings** > General, the software will collect anonymous information about your hardware configuration and how you use the software. Periodically, a file containing the collected information will be sent to Trimble to help us to identify trends and usage patterns. We will not collect any information that can be used to identify or contact you.

You can leave this program at any time by deactivating the option in ⚙ **Settings** > General.